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THE CORNELL ENGINEER

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The CORNELL ENGINEER

Volume 11 Number 7

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Cover: Engineering Co-eds studying.
—Courtesy V. Genove

Frontis: Dry Flashover 60 cycle test of a 161 KV Pedistal type Insulator in the Cornell High Voltage Lab.

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This issue: April, 1946.

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High Voltage Laboratory

Engineering at Cornell (14)

By Prof. S. W. ZIMMERMAN

JUST off the Campus on Mitchell Street is one of the less attractive of Cornell's buildings which houses testing and research equipment for the study of high voltage phenomena. Here full sized electrical apparatus such as used on heavy power systems may be studied under controlled conditions. This apparatus may take on a variety of forms and may be a single comparatively simple structure such as an insulator used to support transmission or distribution conductors, or it may be a more complicated structure such as a transformer, circuit breaker, lightning arrester, fuse cutout, potential device, bushing or other electrical system component.

Because heavy power apparatus is big, the laboratory was of necessity scaled up to meet the problems involved. The building is approximately 120 by 70 feet and is none too large to provide clearance distances for some of the larger apparatus. With a ceiling height of about 60 feet, the three million volts generated by the impulse, or artificial lightning, the generator can be controlled, directed and measured within the building. For larger apparatus than can be brought into the laboratory on freight cars, or than can be erected in the laboratory, there is adequate space in the area on the south side of the building for transmission towers and the like for making prototype tests. A right of way extends for a considerable distance from the laboratory so that transmission line tests may be made. In order to obtain proper electrical clearance distances between the voltage sources in the laboratory and any test structures that might be erected in the yard, about one half the south wall of the laboratory may be thrown open by moving giant doors provided for that purpose. Within the building is a group of smaller rooms serving the functions of office, control room, shop, heating plant, substation, wash room and dark room.

Fundamentally Cornell University is an institution of learning. The High Voltage Research Laboratory is a monument to learning raised by Industry and the University together for the purpose of advancing knowledge in the field of high voltage. Efforts made before the war were successful in bringing to the University expensive specialized apparatus not ordinarily available to an academic institution. A series of planned research programs were about to be taken up but were suspended because of the war effort.

Since the termination of the war, efforts have been made to pick up the loose threads and to weave them into a new pattern of progress. Many problems in this field involve new materials, new designs and new techniques. Others have to do with the serviceability and coordination of older components of electrical systems. Problems of this character are susceptible to solution through the use of the equipment and personnel available in this laboratory. It was intended that this laboratory would provide Industry facilities for making tests and at the same time provide introductory experience for the more advanced students of electrical engineering interested particularly in power work. The specialized training and project work should offer

THE AUTHOR

Professor Zimmerman received his B.S. and M.S. degrees from the University of Michigan in 1930. While at the University, he worked in the Accoustical Research Laboratory of the Engineering School and also worked in the research section of the Detroit Edison Company. From 1930 to 1945, he was engaged in the design and development of devices for the protection of high voltage circuits at the Pittsfield Plant of the General Electric Company. In 1945, Professor Zimmerman joined the Faculty of Cornell as an Associate Professor in charge of the High Voltage Laboratory.

Prof. Zimmerman

more than a bare mention of high voltage phenomena. It is expected that many successful careers will find their beginnings through what the University and Industry together have to offer in this field.

What Can the Laboratory Do?

With single phase voltages available in excess of the highest transmission voltages used or contemplated for some time, Cornell is in a position to make dielectric tests on any full sized electrical structure used today. Limitations in this respect enter only when heavy magnetization currents or when fairly large capacitance currents are associated with apparatus under test.

Arrangements of three 250,000 volt testing transformers supplied by a sine wave generator permit single phase tests to be made up to 750,000 volts or three phase tests up to 430,000 volts. The transformers are arranged so that any of them can be used singly or in two or three units in a cascade connection.

Besides the more or less steady-state kind of testing represented by the use of the 60 cycle transformers mentioned above, the laboratory is equipped to produce and to measure surge voltages as high as 3 million volts. Impulses may be produced which have the definitely specified voltage-time relationships required by the testing standards of the American Institute of Electrical Engineers, the American Standards Association, and the National Electrical Manufacturers Association.

Producing 3 Million Volts

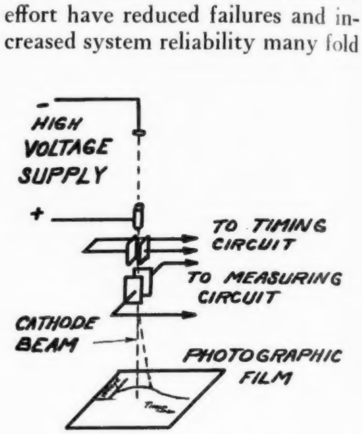
Any desired voltage may be produced by charging capacitors in parallel using a high voltage direct current source, and then through an ingenious arrangement known as a 'Marx Circuit', permitting all capacitors to assume a series connection. The largest generator of this type in the Laboratory consists of 30 capacitors each of which can be charged to 100,000 volts. When these capacitors are discharged in a series connection they are capable of furnishing a pulse of 3,000,000 volts with an instantaneous power rating of over 75 million kilowatts! Because of the short duration this really represents very little energy, approximating only .02 kilowatt hours.

Impulse Testing

Failures of apparatus in service due to lightning and other surge voltages has cost the industry millions of dollars annually. Studies made in the laboratory with artificial lightning strokes have made it possible to obtain important engineering data. Tests made on elemental designs and prototypes have permitted research and development to continue to the stage where great improvements in products have resulted. Apparatus available today is far superior in its ability to withstand high voltage surges as a result of better engineering and better engineering data. Modern apparatus is produced with properly coordinated insulation levels. In most cases the efforts in this direction were also rewarded with increased efficiency and lowered cost through an intelligent redistribution of insulation.

High Voltage lab in East Ithaca

Improvement in protective devices and a definite standardization effort have reduced failures and increased system reliability many fold in the last two decades.



Cathode Ray Oscillograph

Interest has been so acute that during the period 1918 to 1935 more than 400 papers having to do with impulse or lightning voltage, were written in only 5 different monthly publications. Over 200 of these were compiled in a "Lightning Reference Book" published by the American Institute of Electrical Engineers. Hundreds more of these papers have since been written and this work has become a specialized branch of electrical engineering.

There are definite types of test waves accepted as standard in testing electrical apparatus. These are comprised of voltage or current waves which rise at a certain perscribed rate, attain a maximum value in a specific time, and have a definite rate of decay. Specifications of these conditions make it possible to uniquely determine smooth wave forms of exponential character used for standardized tests.

Measuring Impulse Voltages

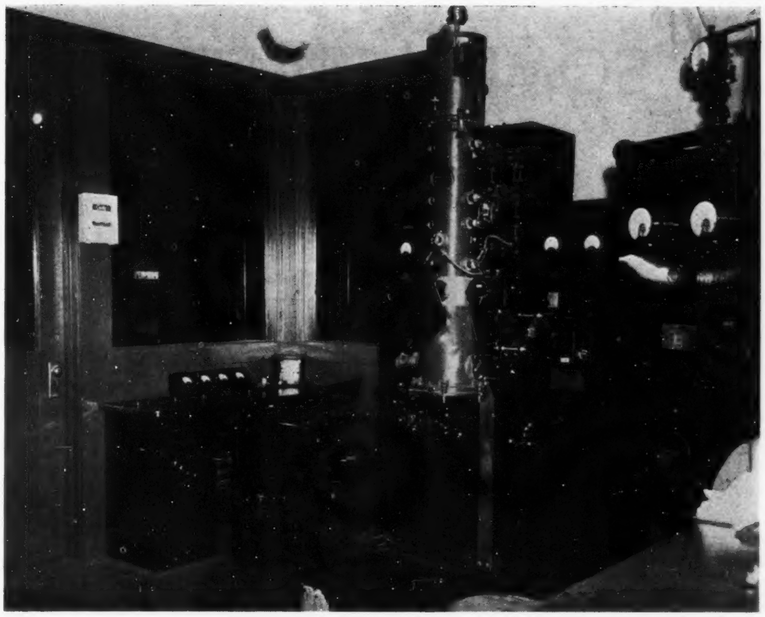
To know what is occurring in impulse circuits, one must be able to measure the magnitude and nature of these electrical disturbances. Inasmuch as this involves seeing what is going on 'while lightning is

striking' a rather complicated set of circumstances must be set up. In the first place the phenomena is not recurrent, so that attention must be focused on a single transient. This transient may be of interest only during the first 1/10 millionth of a second, or perhaps as long as a few hundred microseconds. To study events which occur in such a short interval of time, every component of the test circuit must be alerted to function or to record only that particular time interval. While the entire subject of impulse measurements is beyond the scope of this paper, a few points are interesting.

A special form of cathode ray oscillograph is used to make measurements. A cathode beam is swept across a photographic film in a vacuum at a known rate of travel. Electric circuits properly timed permit a small but known portion of the impulse being studied to arrive at the oscillograph at precisely the right time to deflect the cathode beam from its normal straight line path across the film by an amount proportional to the pulse voltage or current. In this manner a graph of voltage or current versus time automatically results. A study of this graph furnishes complete information concerning circuit and test piece behavior. There are a multiplicity of variations of this technique each having to do with the process of obtaining a particular kind of record which will yield required information in the most convenient form.

Corona and Stress Control

Another interesting branch of the work in this field is the study of electrical stresses in and about electrical apparatus. The effect of these stresses on the life of high voltage apparatus is of great importance. In many instances insulation life can be prolonged by employing rather simple means to relieve electrical stress concentrations. If these stress concentrations occur in air, visable corona may exist. In structures submerged in oil corona may not be apparent. In some apparatus corona is desirable and necessary. In other types of apparatus corona is desirable to a particular and controlled extent, but in the majority of electrical apparatus and electric circuits, corona is not tolerated beyond an unavodaible limit and not desired at all.



Cathode Ray Oscillograph and control for making high voltage impulse tests in the High Voltage Research Laboratory, Cornell University.

Corona in air is that phenomena which causes air to decompose due to the high forces associated with high electrical stress. This decomposition process, accompanied by flashes of light, noise and electrical circuit disturbances, results in air being broken up into ozone, nitrous and nitric oxides, free carbon and a host of other complicated products. In the early stages it can be seen that the process is discontinuous and that energy is associated with it. The electrical disturbances resulting in the electrical system are a clue as to the intensity of the process. They also indicate that a certain stress value has been reached, that value being a function of the type of material or gas in which the corona is being formed.

Measurement of corona losses, power factor and radio noise have become increasingly important to operators who wish to maintain extremely good service records and who wish to remove apparatus that is potentially a source of trouble, thereby avoiding a service interruption.

Power Testing

In studying the operation of power apparatus, question sometimes arises as to what relationship exists between laboratory impulse tests and actual power circuit operation. For some types of apparatus, particularly protective devices, there is no assurance that the devices will perform all of their functions when they are applied to a power circuit. The protective devices may for example, protect against overvoltages but may not protect themselves if they are defective or improperly designed or applied to the system. For a consideration of devices which depend on the power circuits for their operation, combined power and impulse tests must be made simultaneously. Steps are being taken to equip the laboratory for testing in this manner.

Failure of any test apparatus under combined impulse and power conditions may result in rather violent displays of electric circuit operation. With properly installed circuit breakers damage to a sample under test may be kept to a minimum or allowed to progress to any reasonable degree by installing proper control features. Failures inevitably result in system short circuits, which are of no serious consequence in the laboratory, but may represent a considerable expense in the field.

Limitations in design and application uncovered in the laboratory serve to reduce the ignorance fac-

(*Continued on page* 50)

SOME ASPECTS OF QUALITY CONTROL

By PROF. H. J. LOBERG

Head of Department of Industrial and Engineering Administration

DURING the war, the application of statistical techniques for controlling product quality had an almost mushroom growth. Under the proddings of the Services and with the assistance of the War Production Board in cooperation with colleges and universities in training personnel, hundreds of manufacturing plants throughout the country set up control programs. The pressure to increase production, improve quality, reduce inspection personnel and eliminate delays forced the adoption of statistical methods at a rate that could not be considered normal. This development is of particular importance to engineers and management. It needs consideration for its future peace time values.

Since there were pioneers in the field twenty years before this sudden rush who were successfully exploring the adoption of these methods for quality improvement, one may well ask, "If it is so good why was its growth so slow?" "Why did it take the pressures of war to force its growth?" The answers seem to be the usual ones of "resistance to change" and the lack of knowledge of basic principles to permit the adaptation to specific problems. Under normal conditions new ideas spread slowly, especially when they require specialized knowledge and their successful performance demands the support of related groups. Recently, a young engineer just out of the Service commented that he was surprised that some of the plants were not only continuing but expanding the "fancy statistical methods" they had used while at war. He said, "they find that it pays dividends," but he was still skeptical.

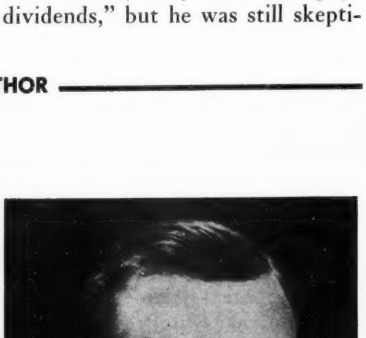
No survey has been made of all plants to indicate just what they are going to do in the future. It is reasonable to assume that some, like the young engineer, are either unimpressed or have not been successful. They will undoubtedly revert to their old methods. There is a mass of evidence, however, indicating that many others recognize quality control as a valuable tool of management. They are building on their wartime knowledge and profiting from their experience.

The emphasis of quality control is on inspection for it is through this medium that the necessary data are accumulated. This, in some ways, is unfortunate for much more is involved. The usual inspection department cannot carry on the work single-handed. The co-ordination of the engineering, production, planning, and inspection departments as well as overall management is essential for successfully improving quality or economically maintaining it at any prescribed level. Since the application of the principles requires some specialized knowledge, the responsibility for the program must be centered in an individual who has that knowledge. In a small concern, it may be only a part-time job; in a large organization the function may be expanded to a department.

It will always remain true that inspection cannot put quality into a product. Inspection can safeguard quality, but if a piece is wrong no amount of inspection will correct it. It is true, however, that intelligent action based on the proper interpretation of inspection results may lead to improved quality. The problem is to define the level of quality needed and desired. Statistical methods aid in the interpretation of data. The control charts and

THE AUTHOR

Professor H. J. Loberg, who during the war was in charge of the Navy Diesel and Steam Engineering training programs here, was appointed head of the Department of Industrial and Engineering Administration this January. Prof. Loberg attended the U. S. Military Academy from 1923 to 1926 and graduated from Cornell with the degree of M.E. in 1929. After working five years in industry, he returned to Cornell in 1934 as an instructor, and received his M.S. in Eng. in 1936. Prof. Loberg, a Professional Engineer in New York State, is a member of the American Statistical Association, the American Marketing Association, the National Industrial Advertisers Association, and S.P.E.E. He is also a member of Tau Beta Pi, Phi Kappa Phi, and Phi Delta Theta.



Prof. Loberg

sampling plans provide a basis for reaching the objectives at minimum expense.

It has been the experience of some organizations that the engineering and production departments have not recognized one important factor in the application of statistics, and that is the variability inherent in any process. This variability is present even when working to close limits such as ±.0001. In a refined operation, the limits of variability are small when measured in thousandths of an inch; nevertheless, they are there. The quality control man speaks of a process or operation as being in control when the variations present are due to natural causes inherent with the operation. It is out of control when the variation is too great to be attributed to chance. Determining what the chance variation limits are is essential to carrying on a quality control program. They provide the opportunity for tracking down the sources of assignable variation and thus establishing time control.

It has been the experience of many that most operations are not under control. This failure means more re-works, higher rejections, or throws the burden on succeeding operations. For example, on a rough turning operation on a gear blank, the original inspection plan checked the operation to make sure that the hub diameter was not too small. The second operation was grinding to size, and the important criterion seemed to be that no actual scrap was produced in the roughing operation. A sample of gear blanks measured for actual diameter indicated that this procedure made everyone play on the high or safe side, with its consequent load thrown on the grinding. In this particular case, the machines were capable of rough turning the blank within the limits set; the only problem was to train operators to work to the specified diameter. This slight change meant a considerable saving, for rough turning is cheaper than grinding (see figure 1).

Another simple illustration was in the case of a product that had a large number of bolts and nuts which of course had to be tight. Although sub-inspections were being carried on, it was found in the final

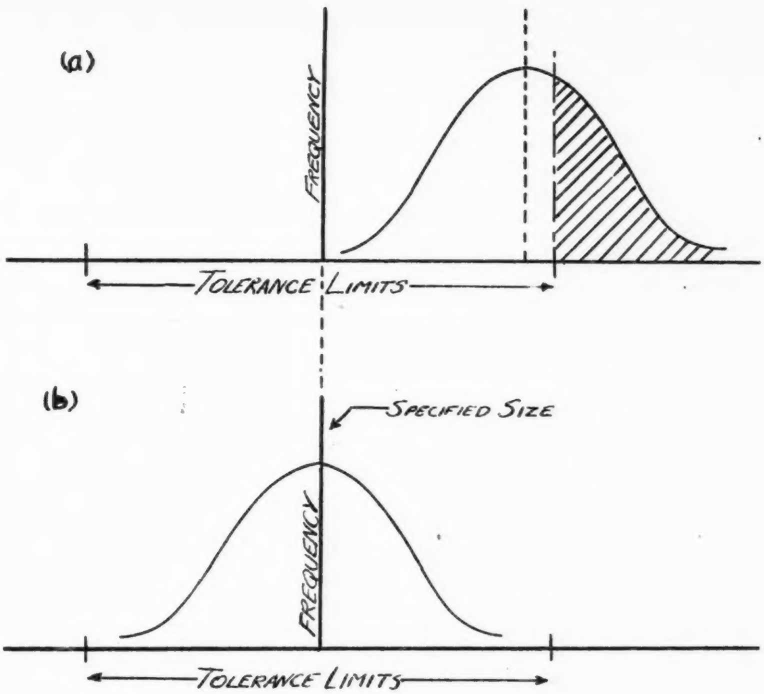


Figure 1.

Curve (b) shows frequency of specified size occurring after training of operations to work to the specified diameter instead of the tolerance limit.

inspection that too many of the nuts were loose. The variation was great enough to cause trouble and indicated lack of control. A study of the method of tightening bolts and the inspection methods used solved the problem. In this case, the fault was inspection methods. The inspectors were testing the tightness by trying to back off the nut. The slight backing off resulted in loosening some nuts just enough to cause trouble on the final test inspection. Changing the procedure to tightening the nut with a torque wrench cleared up the problem. This was not a complex problem, but at one stage it was troublesome to the manufacturer.

Getting an operation under control may involve many factors—machines, materials, workmen, methods, and specifications. In the case of a four-spindle Gridley automatic, a given part being produced ran too high a percentage of scrap. A check of the product from each of the four spindles indicated that one spindle was the culprit. A repair job on this spindle improved the machine and reduced the scrap. Sometimes, arbitrary tolerances are set by the engineering department. A fetish for precision may manifest itself in limits that are absurd. It is axiomatic that close tolerances invariably mean added cost. In one plant, the tolerances for a given piece were set closer than the machines were able to produce with a consequent high percentage of scrap. The normal pattern of the machine was determined from a sample. Having actual facts to work with, the solution of the problem was much simpler than a three-cornered argument with engineering, production, and inspection.

Recognizing that some variation exists from piece to piece as it is produced has saved many hours in adjusting set-ups on automatic machines. Knowing the variation limits, the operator does not change the adjustments when a single piece happens to come on the high or low side. Taking a small sample of five or six pieces and getting their average will indicate whether or not any change is necessary after a preliminary sample has indicated that the set-up is correct. These additional

small samples at reasonable intervals also permit control of tool wear within needed limits. The fallacy of basing judgment on a single item is easily understood. The distribution of parts will be a bell-shaped curve with a clustering around the arithmetic mean. As one gets out on the tails of the curve, the frequency of occurrence is less but some values will fall above and below the mean. Knowing that the frequency distribution is of this nature and realizing that the quality of a single piece may be different than the average of several pieces has produced definite economies in manufacturing.

Since the statistical approach provides factual data, improvements can be made intelligently. This does not imply that the solution is arrived at easily. Bringing an operation or process into control may easily tax the ingenuity of everyone concerned. For illustrative purposes, the solutions indicated in this article have been very elementary. The more complicated ones would require an article in themselves. The solution of difficulties requires time and is more apt to be in progressive stages. At all times, the dollar return must be kept in mind, for when the law of diminishing returns is ignored, management can justly criticize.

Once control has been established, the control charts keep a running record of performance. They indicate not only when the operation is out of control, but frequently indicate trends soon enough for corrective action to be taken in advance of real trouble. The importance of taking corrective action is great. Failure to act in a given situation destroys the effectiveness of the plan and relegates quality control to that area of being something nice to have for conversation, but is not considered a valuable dynamic tool for helping management.

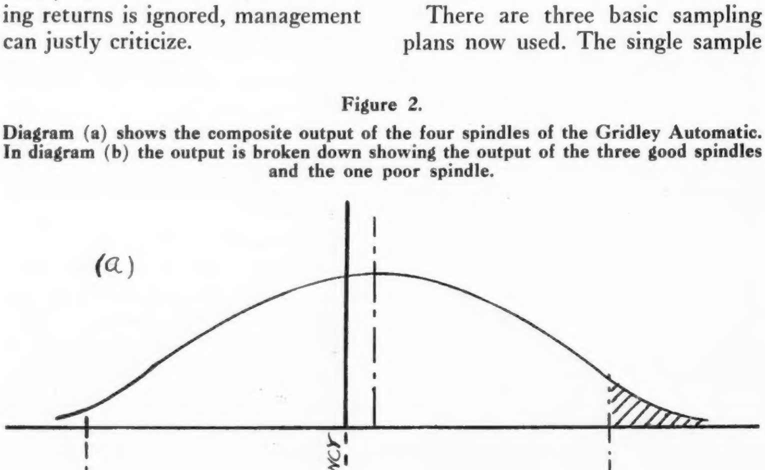
Sampling Inspection

The sampling inspection plans are obvious when the test procedure is destructive. No one argues about their necessity. The question becomes what is the most economical plan to insure a given quality. In those cases, where 100% inspection can be used, it still remains a problem of economy to determine how much inspection is required. It is recognized by many that 100% inspection is not infallible. Pride in 100% inspection may be false as well as costly. Sampling plans can in many cases achieve the desired results.

There are three basic sampling plans now used. The single sample and the double sample plans are more commonly known, for they have been in use for years. During the war, the sequential sampling plan was developed and provides certain advantages as well as disadvantages over the other two. In all plans, the inspector compares the number of defectives found in a given sample, with the acceptance and rejection numbers which have been predetermined to afford a desired protection. In single sampling, conclusions are made on one sample. With double sampling, a second sample may be taken before a decision is reached. In sequential sampling, successive samples are taken until a decision can be made to accept or reject the lot. Each plan has merit and the choice in a specific case is dependent on the surrounding conditions.

Figure 2.

Diagram (a) shows the composite output of the four spindles of the Gridley Automatic. In diagram (b) the output is broken down showing the output of the three good spindles and the one poor spindle.



Receiving Inspection

Since inspection covers not only products made within a plant but also outside purchases, sampling techniques have been effectively used in receiving inspection. Knowing the quality level produced by various suppliers of the same item, can produce savings. In this case, suppliers are analagous to the spindles on a turret lathe. Possibly, one or more are causing trouble.

In those plants where statistical techniques have been carefully developed, considerable savings have resulted. These savings can be measured in actual dollars or in improvement in quality at no added expense. The Ordnance Department has stated that by these methods, they reduce inspection costs thirty per cent while tripling the volume of goods. Throughout the country one will find companies who recognize real value in a complete quality control program, for management realizes that it is a very helpful tool and not a bag of tricks. The Bell Telephone Laboratories use the name "Quality Assurance" which is more descriptive and meaningful. In the days to come when production is a key problem and customers are hungry for goods, sound management will be concerned about quality assurance for the long haul. Management and engineers must not only be aware of this development, but utilize its value to the highest degree possible.

PI OMICRON

By BILLIE P. CARTER, ChemE '49

Last month, a very distinguished white-haired lady delivered an inspirational message to the women engineers of Cornell. The lady was Dr. Lillian Gilbreth, one of the foremost women engineers. Her audience of girls listened intently to every word, for they had long wondered if their choice of a profession was a foolish venture, with no tangible goal at the end of years of hard study. Dr. Gilbreth gave freely of her advice and her knowledge of the problems which must be faced by the women engineers, as *women* and as *engineers*. During the discussion she also touched off an energetic movement which has culminated in the formation of an engineering honorary society, Pi Omicron.

History

At various times in the past years, women's engineering organizations have been started at Cornell; but for lack of time, working interest, and even members, most of the attempts have ended in failure. In the Fall of last year a general meeting of all Cornellian women engineers was called together by Eve Freyer, EE '47. The outcome of the get-together showed that the girls were very much interested in a permanent organization. Working toward that end, some of the more enthusiastic interviewed Dean Speight and Dr. Allen, student counselors, on the subject, and received from them a lot of good advice and recommendations which they were able to present to the girls at another general meeting soon after. The main purpose of this Women's Engineering Association was to help largely with the orientation of freshman women engineers, to do research and help with specialization and placement of the engineers after graduation, and to hold social get-togethers so as to acquaint each of the engineers with all her fellow-sufferers in the other three engineering schools. No formal constitution was written because most people were justly afraid that a small group would perish in the throes of phrasing such a document, and the whole group would lose interest and energy in the main purposes and functions of the proposed organization.

That was the situation when Dr. Gilbreth arrived in Ithaca. She prefaced her talk with greetings from the women engineering students of Syracuse University (whom she had just visited), and with the news that "they have started the first women's engineering honorary fraternity—10 women in the group," and that "they hope to share information on the project with women in engineering all through the country." Later discussions with Dr. Gilbreth and Dean Hilton, counselor of women students at Syracuse University brought out more details of this new honorary society, called Pi Omicron. Dr. Gilbreth was very enthusiastic over the idea of making Pi Omicron a national organization, and a description of the reasons and aims of the honorary society was enough to convince the girls that an organization of that type was the logical solution to the problems which the previous loose association had not been able to cope with satisfactorily.

Organizers of Pi Omicron of Cornell. *L to R standing*: Diana Silver, EE '46; Jean Mount, CE '47; Harriet Ross, ME '47; Billie Carter, ChemE '49. *L to R seated*: Nina Sandberg, ChemE '49; Shirley Ogren, ME '47.

Pi Omicron of Syracuse is a very new organization, having been chartered March 9, 1946. The Cornell chapter of Pi Omicron was established March 26, 1946, after much deliberation, and establishment of specific aims and plan of organization. In advising the group on their proposed society, Dr. Gilbreth brought out that all action toward this national organization should be concerted, and all universities should act in unison; and that no action should be taken that might cause friction between men and women in engineering. For the latter reason she and all the women engineers are very strongly against an all-inclusive professional organization. In accordance with this, Pi Omicron, as the small nucleus, will coordinate activities, and unite all the engineering women of Cornell.

Purposes

The general purpose of Pi Omicron shall be "to encourage and reward scholarship and accomplishment in the field of engineering studies among the women students of engineering colleges; to promote

Three freshmen engineers find time to get away from physics and calculus to relax around a piano and enjoy a talk session.

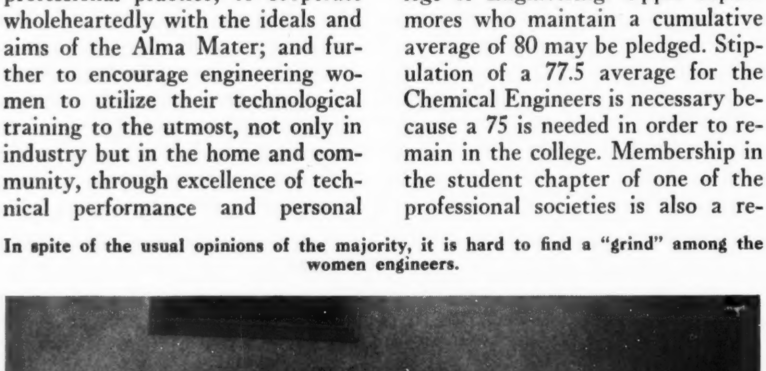
the advancement and spread of education in the science of engineering among women; to foster principles of honesty and integrity in professional practice; to cooperate wholeheartedly with the ideals and aims of the Alma Mater; and further to encourage engineering women to utilize their technological training to the utmost, not only in industry but in the home and community, through excellence of technical performance and personal character."

Besides these general purposes which shall be the aims of all members of Pi Omicron everywhere, there are specific aims which the Cornell chapter is now at work on. These specific aims of the honorary include: 1) Freshmen orientation; 2) Promotion of good feeling among all engineering women by social get-togethers; 3) Promotion of all engineers' participation in extra-curricular activities; 4) Aid with placement after graduation; 5) Correspondence with Cornell engineering women graduates; 6) Lectures by well-known engineers, and discussions for all engineers interested.

Requirements

To be eligible to Pi Omicron, a feminine candidate for a bachelor's degree in engineering must have a cumulative average of 75 in the schools of Mechanical Engineering, Civil Engineering, and Electrical Engineering, and of 77.5 in the school of Chemical Engineering. Candidates are eligible after the completion of four terms in the College of Engineering. Upper sophomores who maintain a cumulative average of 80 may be pledged. Stipulation of a 77.5 average for the Chemical Engineers is necessary because a 75 is needed in order to remain in the college. Membership in the student chapter of one of the professional societies is also a requirement. Participation by the candidate in extra-curricular activities, evidence of service to the Alma Mater, good citizenship, and leadership will be considered in each case before the election.

In spite of the usual opinions of the majority, it is hard to find a "grind" among the women engineers.



Graduate students not available for election to Pi Omicron as undergraduates may be pledged if the records of their undergraduate or graduate work qualify them for membership. Membership shall consist of three classes: active, alumni, and honorary. Honorary members shall include any person who has done distinguished work in the field of engineering and who possesses such qualities as Pi Omicron fosters.

Any person eligible for honorary, active or alumni membership shall be nominated by a committee consisting of two faculty members and the executive council.

The charter members of Pi Omicron of Cornell are Nina Sandberg, ChemE '49; Rosemary Williamson, EE '47; Eve Freyer, EE '47; Shirley Ogren, ME '47; Faith Gregory, CE '48; Judith Schneider, ME '48; and Billie Carter, ChemE '49. A general meeting of all engineering women was held March 26, during which a unanimous vote in favor of the new organization was taken. The officers of the honorary are Shirley Ogren, president; Eve Freyer, vice-president; and Billie Carter, secretary-treasurer.

Initiation

On April 14, five representatives of Pi Omicron of Syracuse visited the Beta Chapter here at Cornell. Initiation ceremonies were conducted by Gladys Nottenburg, president of the Alpha Chapter, during the afternoon in Olin Hall. Dr. Fred H. Rhodes, Dean of the College of Chemical Engineering, is advisor for Pi Omicron of Cornell. In a letter to the organizers, Dean of Students, Harold E. B. Speight, said, "I congratulate you on the completion of all your plans for the organization of the Beta Chapter of Pi Omicron. As you know, I have been in favor of the development of your active organization into a professional honorary society for women students in Engineering, and I am glad to register your organization as one of the recognized Cornell societies. With all good wishes."

Cornell Engineers

At present there are 34 women enrolled in the College of Engineering at Cornell: 5 E.E.'s, 2 C.E.'s, 14 Chem.E.'s, and 13 M.E.'s. This is an unprecedented number; for the past records show a maximum of four or so girls enrolled in the whole college at one time. In many years there were no girls at all registered. Then came the war. Engineers were needed, and even the most hard-boiled employers were willing to employ women in their industries.

There is a rather high bust-or-transfer rate among the women engineers in the first years of college. This is true of the men, too, but, because there are so few, every one seems to notice a girl bustee more quickly. The class of November, 1943, started with seven girls in M.E., one in E.E., and one in C.E. The lone electrical engineer quit to get married, one M.E. transferred to E.E., two M.E.'s transferred to the arts school to become psych majors, another M.E. married her calculus instructor (a Chem.E.), and still another, a married M.E., left to have a baby. The final count at present gives two M.E.'s, one E.E., and one C.E. still holding the fort. The percentage of those remaining is as good as that for percentage boys remaining, in spite of everything.

Of the few women engineers who have graduated from Cornell in the past years, the majority have made use of their technical training in industry. Many have successfully combined marriage and an engineering career. A few examples are Gertrude Goodwin, E.E. '31, draftsman and secretary for Frew Machine Company; Mrs. Nicholas Welch, M.E. '35, Pratt and Whitney Aircraft Company in Hartford; Jeanette Knowles, M.E. '40, of Knowles Tool Corporation; Miki Haven, M.E. '45, formerly Managing Editor of the *Cornell Engineer,* G.E.; and Inez Leeds,* Chem.E. '46 with Hercules Powder. Mrs. Beatrice Mead Hagedorn, E.E. '42, is doing research work in Bell Labs. An outstanding undergraduate, Mrs. Hagedorn joined the regular staff of control operators at WHCU. She was the only one known to NBA officials to be serving as a full-fledged control operator anywhere in the United States at the time. She was also the first woman in twenty years to take the "straight" E.E. course.

Pi Omicron hopes to initiate and sponsor engineering women activities on campus—social activities, also, like the one pictured above.

The two most popular questions asked of engineering girls are, "Why in the world are you taking engineering?" and "What do you expect to get out of it when you get through?" The first answer to the former is that girl engineers like engineering (surprise!), and are more happy working a mechanics problem than reading fifty pages of ancient history. When very young, many decided, with the help of engineering fathers, that engineers are fascinating—and thus the choice of career. Most are glad they made the choice, and stuck with it in spite of the odds. Engineering may be slightly harder than Home Ec but the result is well worth the extra effort. The girl who choses engineering as a career can expect a job after graduation—working in the field which she wants above all others. Even if she doesn't practice in industrial fields, the woman engineer can use her technical training as a household or community engineer.

As might be expected, a lot of humorous incidents have occurred because engineering professors and male students alike are not quite accustomed to having girls in their classes. There is the professor who, amused at having three senior girl electrical engineers in his class, turns to the three after a point has been debated with, "And what is the opinion of the female contingent?" Many freshman boys have been utterly dumbfounded at finding girls registered in engineering with them—after the first feeling of disbelief is dispelled, the usual reaction is a great self-confidence. For, after all, "if a girl can do it, boys shouldn't have any trouble."

Outlook

Most engineering students have a pretty good idea of what they are suited for, and what they would especially like to do in industry, whether it be research or administration. Special opportunities are open for women in laboratories—telephone, radio, aeronautic, and electronic labs. For the Chem.E.'s, there is specialized research in cosmetics, pharmaceutics, etc. Women engineers have proved themselves capable in both research and administration.

Women in engineering is a definite thing now; the ice has been broken. Whether or not more opportunities will be available in industry in the future will depend mainly on the ability of the engineering woman to live up to such qualities as Pi Omicron fosters—especially in utilizing to the utmost her engineering training at all times in industry, and in home and community as well.

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*See Prominent Engineers, *Cornell Engineer,* March 1946.

THE FIVE YEAR PLAN

By ROBERT H. OLSON, ChemE '46

IT has been generally recognized by the engineering faculty at Cornell that the education of the student in engineering should be broadened to include more non-technical subjects. To accomplish this expansion, the faculty has taken a large step forward, and has established five year courses in the major branches of engineering, Civil, Mechanical, and Electrical Engineering. Chemical Engineering has had a five year program for some time. These new programs are not optional, but will be regular required courses, starting in the fall of 1946. There are not very many schools, as yet, that require a five year program, so that Cornell is really pioneering a new trend. Most students are not aware of these developments, and it is the purpose of this article to present a somewhat more complete picture of the five-year program than has been available up to the present time.

Discharged veterans who entered the Armed Forces prior to July 1, 1946 will be permitted a choice of the four or five year curricula providing they enter the University before September 1947. Non-veteran civilian students entering in September 1946 and thereafter will be required to take the five year program. Veterans who left the University before graduation to enter the Armed Forces will be permitted a choice of either the four or five year curricula.

Perhaps the first question brought up in the mind of the student concerns the change in the schedule of courses. How is one more year of school going to affect the normal course? The changes are somewhat different in each school. In the school of civil engineering most of the forty-four credit hours added to the original required number of 141 hours is taken up by administrative and liberal courses. Also the number of technical courses will be increased.

The mechanical engineering curriculum will have thirty-four credit hours added to the present number of 146. An innovation in the curriculum will be twelve hours for a project and related courses. The student selects a project in either a technical, managerial, or a related field in his option. The option may be any of the many branches of mechanical engineering. This project has as a purpose, the application of the fundamental concepts learned in the previous four years. Also, the mechanical engineer will find that he has more opportunity for other liberal or technical courses, which are of interest to him.

The change in the electrical engineering curriculum will be somewhat similar to the change in the mechanical engineering curriculum in that the students will also have a project in which original work in some option will be done. The new curriculum will have a total of 181 required hours which represents an increase of thirty-five hours over the old program. These extra hours will also be used for cultural and managerial courses.

There will be no change in the chemical engineering course since this school has been operating on the five year program from its start.

The trend in the new program will be to give more training in leadership by adding administrative engineering and managerial courses, while at the same time strengthening the technical training and cultural background.

The general changes in the engineering curriculum have already been mentioned. Now the prospective student is probably wondering how this new five year program will affect him. Of course, it means that he must stay in school one more year, and that means more finances. The scholarships directly controlled by the engineering school such as the McMullen scholarships will be increased to cover the additional time. It is hoped that some arrangement will be worked out in the near future so that the other types of scholarships available to engineering students will also be increased. If financial problems resulting from the additional year do arise, the increase in starting salary for a student with a five year degree would counteract any such problem considerably. Perhaps a more important effect on the student would be the factor of increased time. The student mght feel that it is best to finish college at as early an age as possible, but industry will certainly recognize and profit from the additional maturity of the graduate.

Five years gives the student a much better chance to assimilate and really learn the fundamentals of engineering, because the courses are more evenly distributed in the available time. During the war the accelerated program showed us how hard it is to keep working and really learning when technical courses follow each other in rapid succession. The five year program will break up the schedule of technical courses with some required humanistic

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PROFILES

Of Outstanding Alumni

GILMORE DAVID CLARKE, '13

ON the 19th of June, 1904, Professor William Lyon Phelps in Woolsey Hall at Yale University, read a citation preceding the presentation of the degree of Doctor of Humane Letters by President Seymour, which closed with these lines: "Among Americans in the arts today, both from the point of view of creative achievement as well as public service, Gilmore David Clarke stands preeminent. Vigorous, versatile, broad in his interests, he is with fruitful results devoting his life to making his community, his State, and the Nation a finer and more beautiful human abode."

"Slim," as Clarke was called in his college days, entered Cornell in the fall of 1909. There was no family precedence to guide his choice of institution; instead a friend urged him to enroll in the College of Agriculture with the Class of 1913. He graduated with his class, having majored in landscape architecture, a course of study subsequently transferred to the College of Architecture, where it is now located.

Following graduation, Clarke gained experience in his elected profession and in the art of city planning by assisting in the preparation of a report and plan for Albany. Then for two years he served the Hudson County (N. J.) Park Commission as resident engineer.

Soon after graduation from Cornell, Clarke became interested in Scouting, avocationally, and was elected Scout Commissioner of the Borough of the Bronx in New York City. One of the members of the Bronx Parkway Commission, William White Niles, prevailed upon him to accept the post of Superintendent of Construction of the Bronx River Parkway, which runs through northern New York City and southern Westchester County, the first parkway ever built.

The first World War interrupted his civilian activities and Clarke enlisted at Camp Plattsburg in April of 1917 in the engineer company. He was accepted as candidate for a commission in the Corps of Engineers. Clarke asked to be assigned to the Regular Army and in July, 1917 was appointed a 1st Lieutenant and assigned to the 6th Engineers. The Regiment went to France late in 1917, saw service on the Somme with the British Army in February, March and April, 1918, and then, as the engineer regiment with the 3rd Division, took part in the battles of the Marne, St. Mihiel, and Meuse Argonne. This service completed, the Division became an element of the Army of Occupation, remaining on a sector of the Rhine between Coblentz and Bonn until early 1920. Clarke received the Silver Star Medal, Order of the Purple Heart, and the Croix de Guerre with Palm (French).

When the 3rd division was required to have shoulder insignia, Capt. Clarke submitted a design in red and white. Brigadier General Brown asked the reason for the color, and Clarke replied that he guessed it was because he is a Cornellian. The General retorted, "Well, I'm a Yale man, make it blue." The insignia design in blue and white for the 3rd division remains today.

Upon his return to the United States early in 1920, Clarke took up again his duties of Construction Superintendent with the Bronx River Parkway, a task completed in 1923. Thereupon he was appointed Landscape Architect of the Westchester County (N. Y.) Park Commission and for the next eleven years Clarke was chiefly responsible for the design of that system of parks and parkways, which represents an expenditure for land and construction of over eighty million dollars. Later, as the Consulting Landscape Architect for the Department, he assumed responsibility for the preparation of plans for many parks and playgrounds and for several parkways to provide productive work for approximately 80,000 men then on relief and assigned to the Park Department. Thus during the next four years the park system of New York City was expanded and enhanced, becoming one of the most comprehensive in the world.

Among the important parkway projects which Mr. Clarke designed are the Saw Mill River, Hutchinson River, Bronx Extension, and Cross County in Westchester County; the Mt. Vernon Memorial Parkway in Virginia, and the Bronx-Whitestone Parkway, and Henry Hudson Parkway (including Riverside Drive) in New York City.

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Mr. Clarke

—*Courtesy Blackstone*

Bob

PROMINENT

Robert Olson, ChemE

BOB Olson denies having accomplished anything out of the ordinary, but the lowly undergraduates are almost reverent about the extent of his achievement; for Bob is the one and only tenth termer in the Chemical Engineering School. Furthermore he has reached this goal without acquiring the usual ChemE mannerisms: the glassy look and the stooped shoulders. Instead Bob has retained a distinguished air and dapper appearance, due not only to his natural Swedish equanimity, but also to his ability to handle successfully whatever his profs dish out.

Bob was born on January 14, 1925, in Rochester, N. Y. He can't remember his grammar school days very well, but we are sure he was always first in his class. His family moved to Pittsford, suburb of Rochester, and so Bob attended Pittsford High School, graduating from there in June, 1942, as valedictorian. Pittsford High School must have been impressed by the Olsons, for brother Ken (another ChemE, and returning veteran) had just taken top honors the year before.

Bob had his first real summer job in '42 as a timekeeper. Then in September, he entered the Cornell School of Chemical Engineering. In his freshman year he joined Sigma Pi fraternity; and, because he has an excellent voice, the Men's Glee Club and Sage Chapel Choir also claimed him.

Bob has been in the accelerated program until the end of his eighth term. Last summer he "took it easy," getting practical experience by working as a junior chemical engineer for the Atlantic Refining Corporation in Philadelphia. In spite of his heavy schedule he took on extra duties as lab instructor in Unit Operation Lab (the dread 710) during his seventh, eighth, and ninth terms.

Bob is an outstanding exception to an oft-repeated hypothesis that an engineer is smart but lacks versatility, for reputedly an engineer is governed by the slide rule and is always found with his nose in the current text book. Bob has written for the CORNELL ENGINEER, and was elected to the staff last year. He is president of the Chemical Engineering Student Council, and was recently elected president of the Cornell Men's Glee Club. As for sports —skiing, tennis, and golf are tops on his list.

At present Bob is working hard on his senior project—the size classification of small particles. When asked what he thinks now of Cornell's Chemical Engineering School, he replied "best in the country."

Adam Paul Friederich, CE

IT'S so interesting, it doesn't seem like work," expresses Adam Paul Friederich's interest in Civil Engineering. This is especially true of structural work in which Adam is majoring. Just to keep everyone straight, Adam has decided to use his middle name to eliminate confusion with his father, and is now known as Paul.

Paul has been around construction jobs with his father, a Rochester contractor, since he was three years old. That and the fact that most of his antecedents have been engineers and builders seem to have set his path for him. "I've wanted to be a structural engineer ever since I passed through the explorer and truck-driver stage," according to Paul. True to his desire, he has already had two years experience as timekeeper and assistant engineer on various construction jobs.

An after-dinner conference with the director of admissions of Union College in the spring of 1943, convinced Paul that he should skip a year of high school and graduate that June. In May of that year he visited Cornell to see the "glory above Cayuga" which several of his friends had described to him. In spite of rain and a departed student body, he decided that Cornell was to be his Alma Mater. With about 3000 V-12's and a few other civilian freshman, Paul entered Cornell in July '43.

Paul began college as he finished, with extracurricular activities playing a role almost as important as his scholastic work. That is according to his belief that college is a training ground for working with people in a community, as well as an institute of scholarship. As a result the story of Paul's life at Cornell is largely a list of activities and their continuance through the war period.

The first activity Paul looked up was the Sage Chapel Choir. He has been a member for nine terms and served as president during his junior year. The Cornell Daily Sun also received Paul's attention his first term. When war pressure finally downed that paper, however, Paul joined the staff of the CORNELL

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Paul

ENGINEERS

Galip Arkilic, ME

SIVAS, Turkey is a long distance away, but it's home to me," "Ark" admitted, as he reminisced over his grammar school days. "I never dreamed at that time that some day I'd be a graduate of Cornell."

How Ark became a Sibleyman is an interesting story, which began in 1935 when he completed high school. After a little urging he modestly admitted that he was pretty good in math, physics and chemistry. In fact, during his senior year he designed and built his own lighting system for his home laboratory. It was no wonder then that his government offered him an appointment to the Military Academy of Turkey. The rigorous training he underwent was similar to that offered at West Point. As a Field Artillery cadet, Ark's specialty was the computation and preparation of firing data. After graduation in 1939, he spent several years with the regular army in the field. During this period he received his promotion to first lieutenant.

Recognizing his capabilities along technical lines, the Turkish government selected Ark for engineering training here in the United States. In 1944 he put his uniform away and started his journey to the States. After a train ride to Cairo, a plane trip to Casablanca, he boarded Liberty Ship No. 113 for the Atlantic crossing. This was rather a coincidence, for 113 was the designation of the regiment in which he first started his command functions as an officer. Landing at Newport News, Virginia, Ark proceeded to Washington, D. C. There he was given his choice of academically accredited engineering schools. "I chose Cornell because my brother officers always spoke of its beauty. They were certainly right." While at Cornell Ark stuck pretty closely to his books. The accelerated schedule really kept him busy. In August, 1945 Ark was pleasantly surprised by a cablegram from Ankara which notified him of his promotion to Captain. Shortly before graduation Ark rather sentimentally admitted that he was sorry to leave the campus.

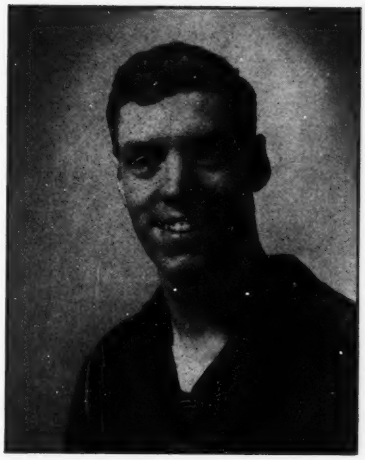
During the next year he intends to get his M.M.E.; and, following that, some practical factory experience. Some time in 1948 Ark will reverse his former steps, return to Turkey, don his Captain's uniform, and enter the Ordnance Department of the Turkish Army.

"Ark"

Thomas E. Talpey, EE

ON the twentieth of March, nineteen-hundred and twenty-five, at Auburn, New York, Thomas E. Talpey first saw the light of day. He is the second son of a prominent banker and a Smith girl. As a member of the Boy Scouts, he attained Life rank.

His first experience along electrical lines involved power engineering. He was operating the lighting switchboard at a High School play during the first year of the war. At that time, the reading of a paper on what to do in case of a blackout was required before every public performance. While this paper was being read, Tom decided to douse the house lights, leaving the footlights on to illuminate the reader. The footlights, however, were accidentally off, so as he slowly dimmed the house lights, the blackout edict was illustrated to the consternation of the reader and the delight of the audience. At this point, he decided to be a communications man.



Tom

Tom's high school record is definitely an enviable one. He was valedictorian of his class, with a four-year average on regents examinations of 98.4 per cent! He was business manager of his school annual, and voted most likely to succeed. Wanting an appointment to either West Point or Annapolis, three days before the final regents exam he found that he needed another year of history. Borrowing an old exam and a review book from the school principal, he studied for those two days, and made a 96 on the regents! Incidentally, he received an appointment to West Point, but was rejected at the physical because of slightly flat feet. In addition to all this, he delivered papers, worked on a farm, and "fooled around with radio quite a bit." He was a life guard, and out for tennis.

He entered the school of electrical engineering in July, 1943, as a civilian. In November of that year he was accepted at Rochester for V-12, but before the end of the term when he was to be inducted, he was drafted into the Navy. At Sampson he was again accepted for V-12, but this double acceptance fouled up the Navy for weeks while Tom waited in OGU. Finally, four days before the beginning of the Spring

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NEWS OF THE COLLEGE

Gibbs Retires

Dr. R. C. Gibbs, chairman of the Department of Physics at Cornell University since 1934, announced recently that he will retire on his 68th birthday, July 1.

He will be succeeded as chairman of the department by Dr. Lloyd P. Smith, professor of physics at Cornell and a member of the faculty since 1932.

During his tenure as chairman, Dr. Gibbs was responsible for an expansion of research work, largely in the fields of nuclear physics and electronics. It was also during his chairmanship that pioneer work was done in cosmic rays, and that Dr. Hans A. Bethe developed the theory of the source of solar energy in the laboratories at Cornell.

Associated with the University continuously since 1903, Dr. Gibbs was born in Hume, N. Y. He received the A.B. degree in 1906, the A.M. in 1908, the Ph.D. in 1910. He was named immediately as an instructor in physics, became an assistant professor in 1912, and professor in 1918. He also served as acting dean of the College of Arts and Sciences during 1926-27.

He has combined his travel interests with those of study, doing research in physics at the California Institute of Technology in 1923-24, and in 1932 was appointed a U.S. delegate to the Fifth International Congress on Electricity in Paris.

Dr. Gibbs has specialized in spectroscopy, luminescence, study of the absorption spectra of organic compounds in solution, extreme ultraviolet spectra, spectra of isoelectronic sequences, multiple and hyperfine structure of spectra, fine structure of hydrogen and deuterium spectra, e/m ratio from such spectra.

He is a fellow of the American Physical Society and of the American Association for the Advancement of Science; member and past-president (1915) of the New York State Science Teachers' Association; member and past-president (1937-39) of the Optical Society of America; member of the American Association of University Professors, Phi Beta Kappa, Sigma Xi; national president of Phi Kappa Phi (1927-31); member for six years of the governing board of the American Institute of Physics, and member of its policy committee since 1942; president (1945) of the American Association of Physics Teachers.

New Appointments

The appointment of 12 assistant professors and an acting assistant professor to the Cornell staff has been announced by President Day. The first four named below are to join the Department of Physics.

Dale Raymond Corson has been on leave from the University of Missouri staff since January, 1941. He worked on radar development at Massachusetts Institute of Technology for 2 years, and for the War Department, 1943-45, at Los Alamos in 1945. Corson holds degrees from the College of Emporia, the University of Kansas, and the University of California.

Boyce Dawkins McDaniel has been at Los Alamos since 1943. After taking the A.B. degree at Ohio Wesleyan and the M.S. degree at the Case School of Applied Science, McDaniel came to Cornell where he received the Ph.D. degree in 1943. He was assistant during his 3 years here.

Philip Morrison has been doing nuclear war research at Los Alamos since 1943. He holds a bachelor of science degree from the Carnegie Institute of Technology, 1936, and a Ph.D. from the University of California, 1940. He was instructor at California State College, 1940-41, and at the University of Illinois, 1941-43.

Robert Lamb Sproull has been with the Radio Corporation of America research laboratory working on frequency modulation radar development. He holds the A.B. and Ph.D. degrees from Cornell, 1940 and 1943, and was a President White fellow and a Coffin fellow. He was associated for a time with Eastman Kodak Company and Bell Telephone Company. He taught elementary physics in the Army and Navy programs at Princeton, evenings in 1943-44.

Two appointees in civil engineering, Charles M. Antoni and Lloyd Theodore Cheney, are coming from the Applied Physics Laboratory, Johns Hopkins. Since 1944 Professor Antoni has been doing structural analysis there on work under Navy contract. He took the B.S. degree in civil engineering at Massachusetts Institute of Technology in 1937, the M.S. degree in this field at Lehigh University, 1939. He was research fellow at Lehigh, and from 1939 to 1940 was instructor at Pennsylvania Military College, Chester, Pa. He was construction engineer with the New York firm of Silberblatt & Lasker for 3 years.

Professor Cheney has been senior engineer at the Applied Physics Laboratory since 1944. He took the bachelor's degree in civil engineering at Syracuse University in 1938, and the master of science degree in civil engineering at Lehigh University in 1940. During the ensuing 4 years he was research fellow at Lehigh and worked as an engineer for several companies.

New Association

Seventy-five faculty members and graduate students in the various science departments at Cornell, feeling that the social and political problems raised by the release of atomic energy and other recent scientific developments are the special concern and responsibility of scientists, have united to form a new Cornell society for research and action on these problems.

The organization, to be known as the Association of Scientists of Cornell University, was organized on February 7 at a meeting in Rockefeller Hall, at which Prof. R. C. Gibbs, Chairman of the Physics Department, presided. The principal speaker at the meeting was Prof. R. F. Bacher, director of the new Laboratory of Nuclear Studies at Cornell, who was one of the special consultants to the government on the control of atomic energy.

A constitution and statement of aims were proposed by F. E. Dart

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ALUMNI NEWS

Leroy R. Grumman, M.E. '16, President, and Leon A. (Jake) Swirbul, M.E. '20, Executive Vice President of Grumman Aircraft Engineering Corporation (pictured in cut), were awarded the Medal for Merit from President Harry S. Truman, March 14, 1946. The award was presented by Secretary of the Navy James J. Forrestal at his office, for the President.

The Grumman company produced 17,013 airplanes from December 7, 1941 to the end of the war. In March 1945 they established a world's record for aircraft production by producing 658 airplanes, more than any single plant had ever produced. The Grumman company was also the first to get into production on airplanes designed after Pearl Harbor. This was the Grumman "Hellcat," the fighter plane that spearheaded the Navy's attacks in the Pacific.

The citation accompanying the awards reads as follows: "Leroy R. Grumman, for exceptionally meritorious conduct in the performance of outstanding service to his country and its war effort, in the design and production of several of the most efficient types of aircraft supplied to the Navy. As President of Grumman Aircraft Engineering Corporation, Mr. Grumman served as active head of an organization which, by outstanding initiative in searching out and making improvements maintained its aircraft constantly at the forefront of operational and combat efficiency. Mr. Grumman, by furnishing potent weapons, has contributed greatly to the effectiveness of United States naval aviation and its achievement of air superiority in the theaters of war. /s/ Harry S. Truman."

This merit award has been described by President Truman as the highest award that can be made to a civilian. Its military equivalent is the Distinguished Service Medal.

Grumman and Swirbul

E. D. Lewis, Chem.E. 43, is doing work on ballistics at the U. S. Naval Ordinance Test Station at Inyokern, California.

E. A. Lawrence, Chem.E. '41, completed in 1944 graduate work at N. Y. U., leading to the degree of M.Chem.E. He is now with Carbide and Carbon Chemicals Corp. at Oak Ridge, Tenn.

Edmond N. Carples, B.Chem. '20, has been promoted to major in the Army. He is stationed at Pasco, Wash., and received a unit citation for work done in connection with the atomic bomb.

John M. O'Brien, a Cornellian and major in Chemical Warfare, began his duties today as vocational appraiser at the Cornell Veterans' Advisement and Guidance Center. He is on terminal leave from the Army.

Formerly of Rochester, O'Brien received the AB in 1933, the AM in 1934 and the Ph.D. degree in 1939 at Cornell. For 3 years he was examination analyst for the government in the Panama Canal Zone. He entered the Army as a first lieutenant, and served as labor relations officer at the Chemical Warfare Arsenal, Huntsville, Alabama.

Kendall C. White, former Ithacan and College of Engineering faculty member, is among the six men whose appointments of associate professorships at Cornell were announced today by President Day.

Prof. White will become associate professor on industrial and engineering administration Mar. 1. He is the son of the late Prof. Emeritus E. A. White, former head of the Department of Floriculture at Cornell and of the late Mrs. White.

After graduation from Cornell with the degree of electrical engineering in 1934, White was employed until 1937 in the testing department and laboratory of the General Electric Company. He was instructor in administrative engineering at Cornell from 1937 to 1940, and assistant professor until he entered military service July 1, 1942. He attained the rank of lieutenant colonel in the Signal Corps, having 27 months' service in the African and European theaters.

Murray F. Crossette, C.E. '02, after thirty-five years of manage-

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Recent Developments In Engineering

Techni-Briefs

Power-Plant Package

A 5000-kw. power-generation unit—including steam turbine, condenser, generator, and auxiliaries—complete as one unit has been developed. Such a unit, compact and ready to put together, is intended for installation abroad where small, ready-designed power plants requiring the minimum of erection time, skill, and preparation are needed. It is also suitable for use in any other location where simple, compact plants of small output are required.

The package is essentially a combination of standard, thoroughly tried power units—but integrated as to design for maximum compactness and simplicity. The condenser also serves as the foundation superstructure. Upon it rests the turbine, the generator, and auxiliaries. The unit is designed to operate with steam conditions of 600 pounds per square inch, 825 degrees F. total temperature and 28-inch vacuum. It has a fully hydraulic type of governor. The package occupies a floor area of 31 by 13 feet and stands 17½ feet high.

Supersonics

SCIENTISTS through the use of ultra-high sound waves now are able to "see" flaws inside metals, or to "look" through great depths of water to detect submarines, or even to homogenize milk, killing all the bacteria at the same time.

These high frequency vibrations are called supersonics. That is the name given any kind of vibration above 20,000 cycles per second—the highest frequency that the human ear can detect.

Supersonics, which can travel 4,200 feet per second through water, helped tremendously during the war in combating Axis submarines by making it possible to detect the underwater craft at various ranges.

Flaws inside metals of any thickness can be detected by supersonics, which allow scientists to "look" through metals in such a manner as to permit plotting of the approximate size, shape and location of the flaws.

The magnitude of supersonic vibrations obtained and measured in laboratories can be great enough to break metals. It is the accelerations which produce all the unusual effects. The acceleration can be made about two million times greater than the acceleration of a falling stone.

The speed of supersonics is so great that if they are directed through a water-filled vessel and a person inserts a glass tube in the container, the vibrations will be of such a violent nature that his finger tips would be burned, although the water temperature would remain unchanged.

Supersonics also may be used in metallurgy for alloying such metals as lead and aluminum, or for mixing oil with water and other substances which otherwise would be impossible to mix.

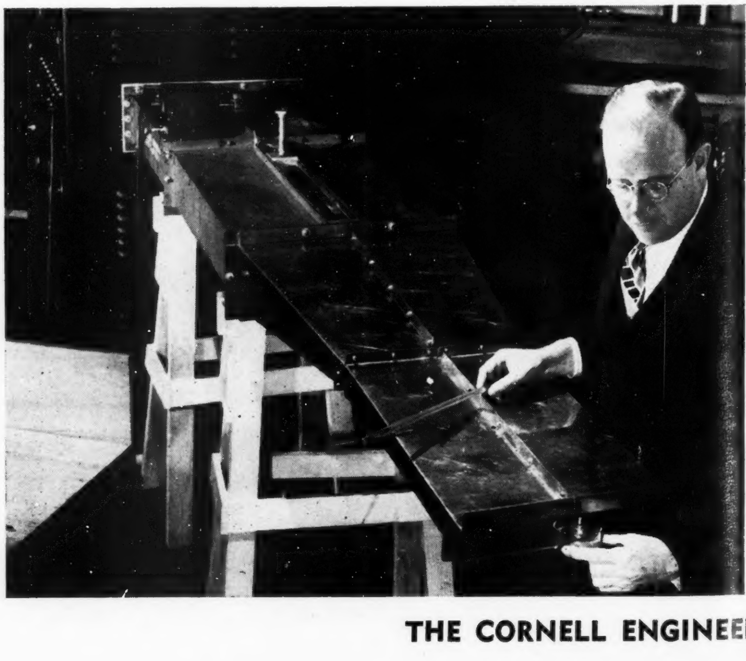
They also can be applied to accelerate chemical reactions, for making better television reception by scanning the picture before it is presented on the viewing screen, for preparing photographic emulsions, for clearing smoke out of the air through the process of precipitation, or to "see" objects through metals.

Electronic Blow Torch

An experimental model of an electronic "blow torch" projects high frequency radio waves on materials. With it the liquid plastic in the dish used in the demonstration can be solidified in three minutes. After further development, this new means of hurling invisible waves will permit projection of high frequency heat on an object wherever it may be, as opposed to present industrial dielectric heating methods in which objects must be placed between metal plates or electrodes, and will assure uniform heating of irregular shapes. Eventually, greater power at higher frequencies may allow "squirting" of the beam from a nozzle no bigger around than a flashlight.

Demonstration of the electronic blowtorch.

—*Courtesy Westinghouse*



Rotascope

General Electric engineers with the aid of a newly-developed instrument—the Rotascope—now are able to make any rotating object appear motionless before their eyes.

The blade of an electric fan, or an airplane propeller, will appear to stand still, even though they're whirling at top speed, when the "optical engineer" is focused upon them.

Developed for the study of airplane propellers under actual operating conditions, the Rotascope is the first instrument of its kind which allows the continuous viewing of a rotating object at any point on the perimeter (or path of travel).

The new device is an answer to the scientific problem for an optical system capable of untwisting the light of rotating equipment before it is recorded by the human eye.

It eliminates the rotary component of motion, but shows any flutter or vibration of the moving part, thereby making it possible for scientists and engineers to make a thorough study of the rotating parts of machinery.

Engineers can actually see what happens to any of the rotating objects while under the strain of thousands of revolutions per minute.

Lowest speeds as well as speeds up to 2000 revolutions per minute can be studied with the Rotascope. Special designs of the instrument can be made for the study of higher speeds.

The "optical engineer" also may be used in industry for the study of angular motions, particularly those of low angular velocities.

Silicone Oils

Silicone oils that flow at temperatures as low as 121 degrees below zero Fahrenheit, without congealing, have been developed by General Electric's Research Laboratory in Schenectady.

These oils, prepared with methyl silicone polymers, will be useful as hydraulic fluids for aircraft systems in the operation of flaps, doors, and landing wheels. Silicone oils also can be used on fine instruments, in watches and clocks, and as a dielectric fluid in capacitors and transformers.

The silicone oils have flow points as low as minus 121 F. and may be used at plus 302 F. without oxidation or sludging, their most unusual property being their small change of viscosity with temperature.

The methyl silicone polymers, in the form of elastomers, produce a silicone rubber that does not decompose at plus 400 F. nor harden at minus 67 F., and maintains its elasticity over long periods of time at the high temperature of 302 F. under load.

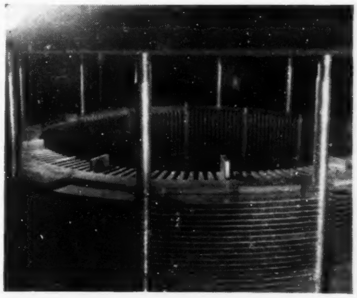
Some methyl silicone resins were discovered which undergo no decomposition or disintegration over a period of years at 392° F. and maintain their dielectric strength for a long period even at 512 degrees Fahrenheit.

Stability at high temperatures is no longer considered to be the only virtue of the organosilicon polymers. Silicone oils and rubber may well prove to be valuable because of their performance at low temperatures, lower than those at which organic oils and elastomers are satisfactory.

Copper Sandwich

A novel method for cooling the stators of large totally-enclosed a-c motors has been developed. It is a simple, but effective thing, and depends on the fact that copper is a ten times better heat conductor than iron. Stator punchings are made of thin copper sheets exactly like the magnetic-iron punchings except they are about two inches longer at the back. These copper punchings are spaced at intervals with the steel punchings giving, in effect, circular fins projecting beyond the stator iron. Because these copper discs are in intimate contact with the iron, where the heat is generated, they are able to conduct heat to the back of the stator, where it can be removed by the air circulated by the fan on the rotor shaft. Because the copper laminations go into the spaces previously occupied by the slots to allow for passage of cooling air the total length of the rotor is actually reduced.

This copper-fin cooling system is particularly applicable to large, totally enclosed, fan-cooled motors where the ratio of exterior surface to volume of iron is small. In small machines the ratio of surface to volume is large (on the basis that the ratio of surface to volume of a sphere decreases as the diameter increases). Undoubtedly this development will mean that larger-size totally-enclosed, fan-cooled induction motors can be built.



Stator Stampings
—Courtesy Westinghouse

Color Changes

The gas turbine, powerful combustion engine which since development has refused to have its temperature taken, has been forced literally to take its own temperature through recent use of a special metal alloy, which tells temperature by color.

The alloy shows a marked color change for every 25 degree change in temperature from 500 degrees centigrade to 700 degrees centigrade, then reverts back to its original color and begins the color scale over again in a higher range of from 725 degrees to 900 degrees centigrade.

Believed to be the highest temperature ever recorded accurately inside a gas turbine, such intense heat would amount to 1562 degrees above zero on an ordinary, household Fahrenheit thermometer, were it able to record that high.

The temperature-taking alloy turned the tables on the gas turbine after practically all types of complicated temperature measuring devices had failed to record faithfully the intense and varied heat created by the turbine wheel, which whirls more than 1,000 miles per hour.

A chrome cobalt composition, the alloy like most metals changes color when being oxidized under heat. Unlike other metals however, this alloy oxidizes so slowly at higher temperatures that each color change occurs regularly at 25 degree intervals thus permitting actual

graduated color scale according to temperature.

But the strangest characteristic of the alloy is that after it completes one order or scale of colors, it reverts back and repeats these colors in a second order in a second higher range of temperature.

On the basis of one hour heat treatment, the alloy at 500 degrees centigrade turns a light straw color, at 525 a straw color, at 550 a bronze color, at 575 purple, at 600 dark blue, etc. The alloy turns light blue at 700 degrees centigrade, and according to all precedent, it next should turn grey, indicating the end of the color scale.

Instead of turning grey however, the alloy at 725 degrees centigrade reverts back to a light straw color and begins the progression of colors over again. The alloy turns light blue in the second scale when it reaches 900 degrees and begins to show greying tendencies at 925.

Interference colors of the alloy change as the thickness of the oxide film changes, until the oxide film becomes so thick or irregular that no color is transmitted through it to be reflected. At this point, indicated by a dull grey surface, oxidation has run its gamut of colors, and the metal is no longer useful as a yardstick for measuring temperature.

Demonstrating just how fine a change actually takes place, the film of oxide on the alloy increases in thickness only two and one half billionths of an inch at every 25 degree change in temperature. By comparison, 12,000 such thicknesses would be necessary to attain the thickness of a single sheet of ordinary writing paper.

Fluorescent Lamps

A CIRCULAR fluorescent lamp, an even foot across and rated at 32 watts, has recently been devoloped. Because of the high light output in a small space and its symmetrical shape, it removes the principal obstacles to its use in portable lamps in the home.

Other new fluorescent lamps are longer and slimmer. Four lengths—five-eighths and one-inch in diameter—and standard, from 3½ to 8 feet long. Their special use is for showcase and decorative lighting, where long lines of low brightness are required. The electrodes are designed for instant starting on high voltage. Long lamps present a starting problem in humid air which is overcome on the "slimline" by painting a narrow silver stripe along the outside of the glass to within a short distance from each end. This metallic stripe acts as a capacitor facilitating starting.

The slimline lamp is slightly more efficient in turning watts into lumens than the regular lamps. This is because a large proportion of fluorescent-lamp losses occur at the ends, and with the "slimlines," for a given length, there is a smaller percentage of loss.

—Courtesy Westinghouse

Sorting tubes for fluorescent lamps.

Fluorescent lamp life and the specific effect of starting is better understood. As a result fluorescent lamps are now rated with consideration of the number of starts. For example, the 40-watt lamp has a life of 6000 hours if it burns 12 hours per start. But if the lamp burns 6 hours per start, the life is 4000 hours; for 3 hours per start, the life is 2500 hours. The efficiencies in per cent of initial lumens per watt when the lamp reaches 70 per cent of its rated life are 70, 76, and 84 per cent under the three conditions above.

Fluorescent lamps decline about 15 per cent in efficiency during the first hundred hours and then at a much slower rate for the remainder of the lamp life. This initial decline has been a matter of much concern and some mystery to lamp engineers. Various theories have been set forth, such as a sort of poisoning of the phosphors by mercury vapor. Research now definitely fixes the blame at another source. It is caused by the low wave-length (mostly 1850A) radiation of the mercury-vapor discharge. This short radiation has a damaging effect on the ability of phosphors to convert invisible to visible light. The cure is still not known.

Constant Speed Machine

THERE seems to be a certain perversity about engineering needs. Sometimes a variable speed is desired for a basically constant-speed machine. Then again a constant speed is sought from one that operates at changing speeds. Worthy of note is one ingenious speed held closely constant regardless of normal change in load, voltage, and temperature.

On the motor-shaft extension is a smooth drum. Surrounding this drum is a cage with lengthwise slots. Resting in these slots and riding on the motor drum are carbon blocks, held in position by garter springs. The cage is connected to the driven load. The motor is arranged so that at all times its speed is above that desired, but the blocks and springs are adjusted so that at the correct rotation the centrifugal forces lighten the pressure of the springs and the carbons slip just the right amount on the motor cylinder.

The resulting speed regulation is remarkably constant. On an M-G Set serving a torque meter, the 400-cycle output is held within one cycle for motor speed changes from 8400 to 11,000 rpm. The output of the set is entirely an instrument load and does not vary widely. At constant loads the variation for all atmospheric conditions of temperature, altitude, and humidity is approximately one quarter of one per cent.

The device is flat compensated for wear but tests show barely measurable change in the surface of the friction members in 2000 hours of operation.

This type of drive is not intended for use with large outputs (it has been built in sizes up to one kw.), nor for wide load variations. A 50 per cent change in load produces a speed change of a little more than one per cent.

Cornell Society of Engineers

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Mr. Leinroth

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

DURING the past years there was considerable controversy over the role which those engineers and scientifically trained men of draft age were to play in the war effort. It was early recognized that this was was to be one in which production and scientific and engineering brains were to play a much larger part than they had played in any previous war. The controversy revolved around the question as to whether these engineers and scientifically trained men were to be drafted for routine duty in the Army or Navy or whether they should be officially assigned to necessary research work, to speeding up of production, to design work or to the many engineering or scientific problems confronting us the solution of which was vital to the success of our armed forces. Were we to have real selective service in the sense that these men were to be placed where they would do the most good?

Our Allies—England, Russia, France and even China had decided on the latter course as had Germany. We alone, while deferring some, assigned most of our young technicians to routine duties in the armed forces. In most cases these men could have contributed far more in the laboratory, engineering office or industrial plant. That our mighty war effort—the greatest by far that the world had ever seen—was of such colossal proportions is a great tribute to and a justification of the principles of democracy and of free enterprise upon which our country was built and which have made it what it is today, rather than to our wisdom in allocating our man power. Our triumph was in spite of it rather than because of it.

Due to the fact that many young men graduating from secondary schools and intending to enter engineering schools, as well as undergraduates in engineering schools, were drafted, there is today a great dearth of young engineers. While many of those returning from the armed services will enter or re-enter engineering schools and complete their courses yet the fact remains that the number of civilians attending these schools in the past four or five years has been a very small percentage of those attending in normal years and it will be years before this deficit in engineering graduates will be made up.

All of this in in the face of a great demand for young engineering graduates. Industrial production and engineering projects supplying civilian needs were necessarily greatly curtailed during the war years and bid fair to go forward on a tremendous scale in the years just ahead of us to make up the deficit. These facts seem to point unerringly to the great opportunities ahead for engineers, particularly young engineers.

But let us not forget that we as engineers have an important and responsible role to play as citizens as well as engineers and that our opportunities for service in that field will also be unusually good. The world is and will be in ferment for years to come. New idealogies will run rampant and cannot help but affect the thinking in this country. We shall have a great responsibility as citizens to examine these new philosophies and social economic theories fairly but always mindful of maintaining those fundamental principles of democracy and free enterprise which so eloquently expressed themselves in our industrial war effort and under which our country has grown to what it is today. Our duties as citizens must go hand in hand with our professional duties. They constitute responsibilities that engineers can no longer afford to shirk.

—J. PAUL LEINROTH

DECITRIG DUPLEXITIES

During the past year many veterans, after separation from the service, have returned to the campus. Here is a letter a typical veteran would write to his point hungry buddy overseas; any resemblance of the following to "corn" is entirely disclaimed:

Dear Buddy,

My name, rank and serial number days are over, and I'm back in engineering school.

Remember the barracks-life days when we used to dream about quiet single rooms, with a private bath? Listen brother, I'm still dreaming. Finding a room was harder than getting a furlough. I finally found half a double in a rooming house holding twelve other jokers. Of course, the first thing we did was to arrange a schedule for the latrines. The other morning someone showered when they were supposed to only shave and five men went without breakfast. But I guess I am pretty lucky. There is a rumor about a veteran who set up housekeeping in a broom closet over in Franklin. Poor fellow, he has to take physical training in order to get a shower.

For married veterans, there is a Vetsburg, composed of pre-fabricated houses which were rushed in and slapped up in time for the Spring term. One lucky family is living in a house composed of five bathrooms.

This place is full of Air Corp veterans, and the coeds are sure having trouble with them. More up-to-date sororities hurriedly established aviation ground school courses. I had a date with one of the sororees. What a beautiful night: the weather was warm, the sky was clear, the moon and the stars were out . . . all I got was a lecture on celestial navigation and instructions for take off.

The clothing situation is almost as bad. Many veterans are wearing their GI clothes; non-veterans are signing up like mad for R.O.T.C. so that they can get a pair of pants to wear to class.

There is a rather clubby combination rendezvous and restaurant just off the campus called the Johnny Parsons Club, and it's here that most of us get our supply of caffeine during prelim week. Near the door of the club is a mirror. Last week, I noticed that 9 out of every 10 coeds glanced into the mirror as they walk out. Today I questioned the one girl who didn't look. She said she was enrolled in the engineering school.

Seriously, though, there are some fine girls taking mechanical engineering, but there is one less, this term. She misread a Physics experiment on the distribution of wave length in a spectrum and was afraid she would be ultraviolated.

Fraternities started rushing again this past term. They certainly work fast. They pick you up in a Packard convertible for a luncheon date at 12:00, entertain you with pretty coeds til 3:00 o'clock, slap a pledge pin on you at 4:00. At 4:30 you are cutting grass while the big upperclassman is writing horrible things about you in your black book.

By now, the "Lost Weekend" must have played at your post theatre. You remember that Ray Milland was a Cornellian. The real story behind the little animals, bats and mice—wasn't given in the picture. The whispered truth here is that Ray Milland was one of the more spectacular cases of the engineer who failed to pass "Strength of Materials" after the fifth try. The natives here maintain he staggered up and down the main street of Ithaca trying to pawn his slide rule before the expiration of his bust notice. His old coed girl friend is now president of the local chapter of the W. C. T. U.

Well, that's about all the news from here.

Yours till dx reaches zero.

Mandrake.

PERSONALS

Engaged

John Wilbur, who will graduate this June, was recently engaged to Desdemonia D. Dritzel, daughter of J. Cornelius Dritzel, owner of the Dritzel Centrifugal Blower Company. J. Wilbur is refusing all job interviews.

Recovered

We note that Smedley Potts brought his convertible back this term.

Engaged

Mr. and Mrs. Byron Smythe announce the engagement of their daughter Edythe to J. Smedley Potts, M.E. '46.

Births

Recently announced was the birth of a son to Prof. and Mrs. Edythe Strigament.

The Professor is head of the Refrigeration and Ventilation Departments. Next term he will offer a course in Heir Conditioning.

* * *

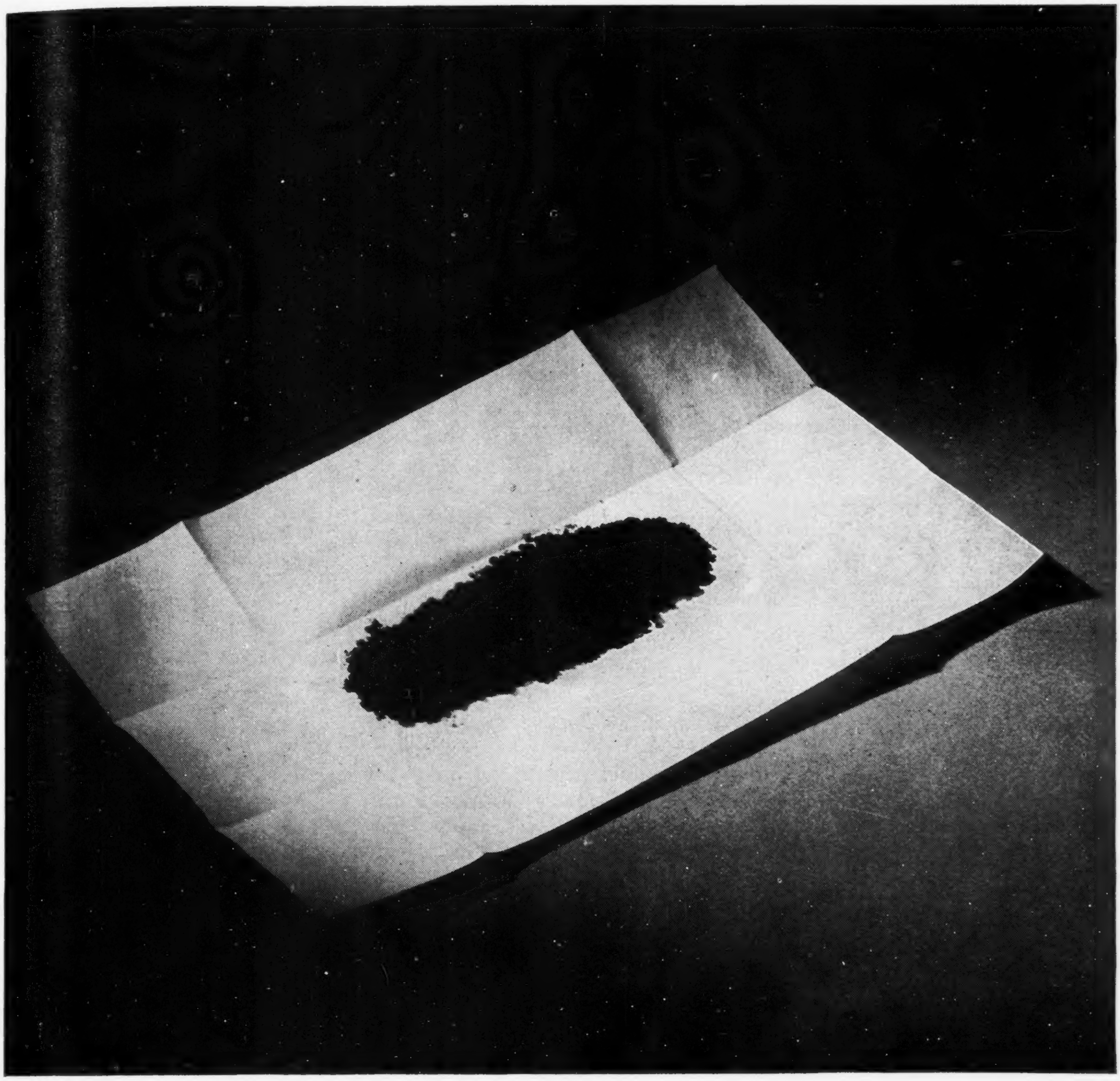
"You old drunken beast—if I was in your condition, I'd shoot myself."

"Lady, if you wash in my condishen, you'd mish yourshelf."

* * *

"Say, but your mother-in-law is thin."

"I'll say. Why, when she drinks tomato juice she looks like a thermometer."



TAU BETA PI ESSAYS

The Engineer As A Citizen

THE engineer, without question, has been instrumental in conferring great material benefits upon mankind. That all of his endeavors have not been so well directed is evidenced by the past terrible destruction of life and devastation of property in the war zones. Certainly the engineer, like any other citizen, has definite duties and responsibilities, even though he has not been well educated and trained to recognize them. Certainly also, since it is the engineer who has played such an important part in making possible this industrial and mass-production era, with its high standards of living, he should at least make a reasonable effort to be helpful in finding solutions to some of those problems which have been introduced or greatly intensified as a result of his efforts.

Let us not think that the engineer's position in the community is solely as an engineer. True, this is his main function, but he must also be an integral part of the community; in other words, he must be a citizen. Think for a moment on the truth that has been passed down to us through the generations that "eternal vigilance is the price of liberty." We glibly recite this phrase, but it fails to penetrate our thinking. We are not concerned, as a people, with the fact that the distractions of modern life and the growing complications of government machinery have tended to make us indifferent to our responsibilities as citizens and that we are slowly, but steadily, drifting toward the edge of the precipice of complete indifference.

During the past few months strides have been made in the right direction by some of our foremost scientists. I refer to the great interest and leadership shown by the atomic bomb scientists as regards world control of atomic energy.

We, the college engineers, are often reminded that we are the future of the country. This cannot mean, it must not mean, that we are only the tools for technological improvements. No, we are to be active citizens in the community. We must assume the duties and responsibilities of the community. This includes not only observance of the laws and regulations, but positive participation in government and cultural activities.

The problem facing us is how to attain this objective. How can we overcome the engineer's inertia? There are two things that must be done. Firstly, older engineers must actively engage in civic activities, for the engineering college student can hardly be expected to take a keen interest in such matters unless he is challenged by such examples. Secondly, the curriculum for college engineers must be broadened to include courses in history, government, and economics.

Advances have been made in these two directions. Let us hope and strive to continue and increase them. The contributions that engineers can make by a more faithful performance of their civic duties can be of inestimable value to their various communities. Moreover, their prestige and status in the community will be further enhanced to the extent to which they participate constructively in community and public affairs.

—Emmett Wallace

Five Years To Etc.

"L'HOMME est sous la table." This well known quotation thought to have originated during the glorious reign of Louis IV, has come to take on more significance through the years. Today it is the battle cry of college students throughout the nation. At Cornell, the haven for decrepit buildings and wayward dogs, the refrain echoes forth from the beer-stained walls of Zinck's on any normal night.

Perhaps the most fortunate day of my life was passed during a week-end planned for ambitious high school students, who did not yet know where they were going to spend their father's money during the next few years. Some kind student, who took an immediate interest in my problem, offered to guide me around the campus. He was called "Brother" by his roommate. Brother and I later came to live in the same house where a twist of fate had gathered together a large number of men with the peculiar name of Brother. But this is neither here nor there.

While eating at that famous Ithaca "steak house" called Zinck's, I lost my escort, Brother. When it became late, I began asking everyone I saw if they knew where Brother was. "L'homme est sous la table!" they huzzahed. Impressed by the apparent ease with which so many people glibly spouted this famous quotation, I immediately knew Cornell was the place for me. Where else could one be in contact with so many learned people at once.

The next fall I bid my family a sad adieu and carrying my small dog under my arm boarded the Conestoga for Cornell. Here the ties I had previously made proved invaluable, for Brother met me as I arrived and for only a $100 fee got me a room in what I was quickly assured was the best fraternity house, with the best men, with the best food and the best beer (on tap at all times) on the hill.

(My dog too was introduced around and thereafter could be seen copulating on the lawn to his

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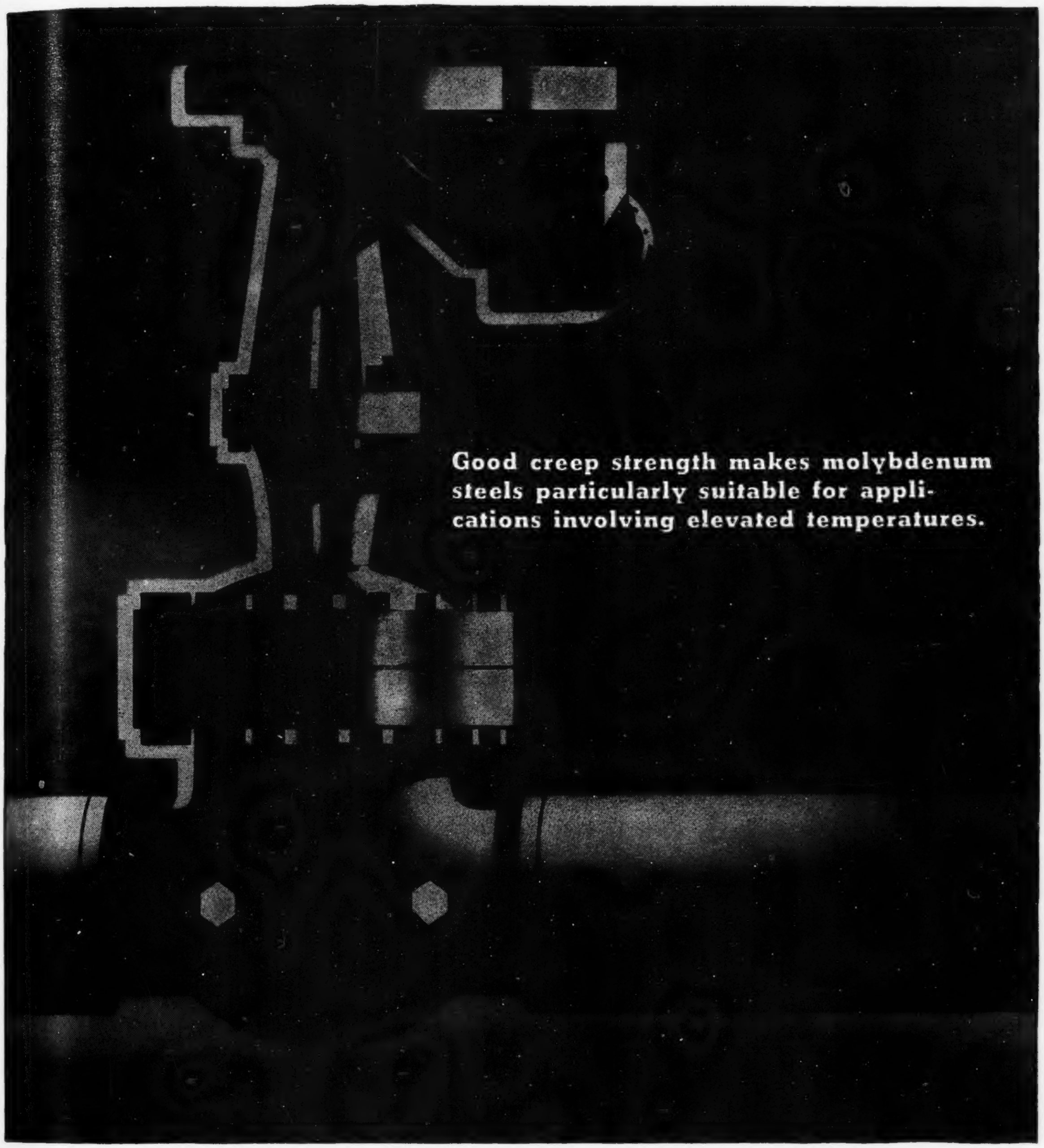
Good creep strength makes molybdenum steels particularly suitable for applications involving elevated temperatures.

Tau Beta Pi Essays

(*Continued from page 30*)

heart's desire almost any afternoon.)

One day shortly following I was approached by a man who lived in the house and who mistook me for one of the boys whose name was Brother. (My name was Hollingsburt, Hollingsburt Birdsel McSmythe.) He explained to me the Cornell 5-year plan. (Not to be confused with the Dusty Rhodes' 5-year plan.) At first I was dubious but when it was pointed out to me that the best years of one's life are spent in college, I naturally agreed to extend my stay to five years. The object of this plan is to bust at least one course each term. I imagined this would be rather simple for an engineer even if rather difficult for an arts student. However my original plan to take up engineering was side-tracked at this interview. After all, dear reader, it is not what you learn in college but the contacts you make, and the chance to drink beer with the group.

My house president advised me to take an informal course called Introduction to Parties 101. This had nothing to do with Republicans or Democrats I later found out. I was rather pleased with this course and elected advance study in the subject for the next three terms. The following year I felt I had found my place and changed from a Greek major to a Party major, and from Schlitz to Budweiser.

My remaining years at Cornell were notable. I am left with mere memories, but what happy memories. No classes! No nothing! Just parties! I shall never forget the honor bestowed on me in my last term. (My eyes fill at the thought.) I was elected to the much-sought-after position of "L'homme qui est sous la table" at Zinck's. If Louis IV could have seen me, he would have been proud.

So prepared, I left the Hill to take my place in society, where I may be found today, still "sous la table."

—Bob Preston

Engineering Education

WHEN one looks at the education system used in England and on the continent of Europe one is easily amazed by the fact that their curricula is far in advance of ours in America.

In Europe the college preparatory education of a student is begun at an age of about twelve. Their learning during this period being mostly in the field of fine arts and all the college preparatory students take about the same courses. Later as the students advance they branch out into the sciences of physics, chemistry, mathematics, biology or wherever their desires lead them. If for instance the student chooses engineering as his life's endeavor he will have had sufficient mathematics, mechanics, physics, etc. by the time he completes college preparatory school to enter into the more advanced terms of an ordinary American college course. In Europe it is pretty difficult to get into a college while here that is not always the case, which results in much more work being done in the preparatory schools than ever occurred in our high schools.

The European colleges are also

(*Continued on page 34*)

Tau Beta Pi Essays

(Continued from page 32)

run somewhat differently than ours. There one is not worried so much about marks but more with learning. Few exams are given during a term. A subject is not just learned for an exam the following week or for the final exam but they must be learned for good. This is because after about three years of study exams are given for about ten days which cover the entire work during this period. These exams may be taken only once by a student. When a European student has completed his college course he has obtained the equivalent of a doctors degree in this country.

Now should such an education system as this be put into effect in this country? On the surface it seems rather desirable. However in this country the education covers different ground than in Europe. Many more students attend secondary schools and colleges here although they sometimes spend more time on athletics and having a good time than on actual study. However they get what they desire and that is what is important. But if a student really wants to learn engineering during the eight terms provided in this country he finds the time rather short. He has spent little time on engineering in high school so he must wait until his first years in college to learn his fundamental engineering. There is no reason why some of these fundamentals could not be taught and taught well in our high schools. This should be more and more possible with our modern large central high schools. Many of the fundamental college engineering courses are within the comprehension of the average high school student, for instance calculus, chemistry, elementary physics, shop courses, etc. If a student could enter college with these fundamentals well in hand, having learned his fine arts earlier, he would not have to spend so much time on them. Instead he could spend more time on the more difficult real engineering subjects.

Such a system if made available to students who really want to learn would produce much better engineers than are being produced now.

—Burton H. Smith

Alumni News

(Continued from page 21)

ment of mining properties and metallurgical plants, mostly in Mexico, is now located as a consulting mining engineer in San Antonio, Texas.

J. Carlton Ward, Jr., M.E. '14, president of the Fairchild Engine & Airplane Corporation is a member of the National Planning Association's advisory committee on the aircraft industry.

Norman E. Wilson, E.E. '37, has resigned as assistant professor of engineering at Thayer School of Engineering, Dartmouth College, to accept a fellowship for graduate study at the Illinois Institute of Technology in Chicago. The fellowship is provided by a grant of Westinghouse Electric Corporation for study in power systems engineering. Wilson's work is under the supervision of Professors William A. Lewis, Jr., former director of the school of elec-

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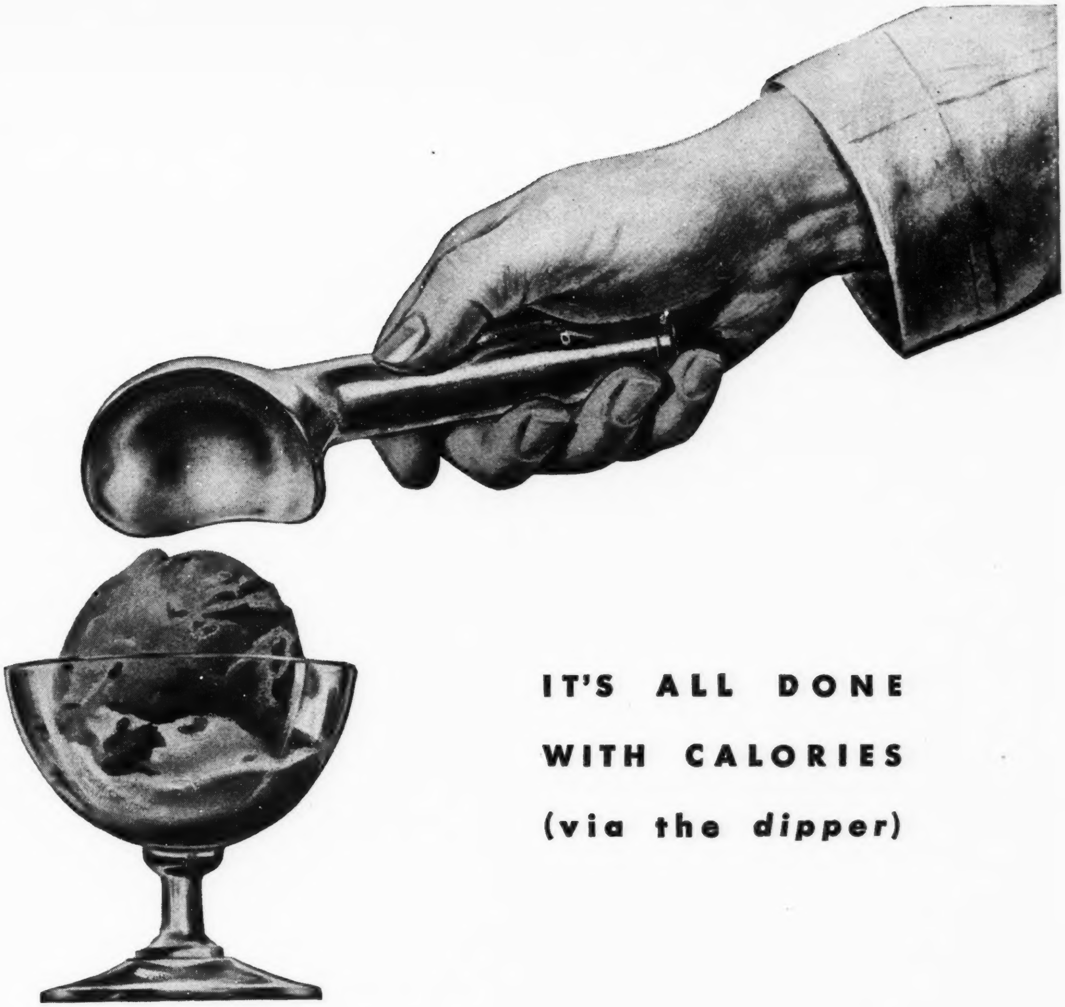

Alumni News

(*Continued from page* 34)

trical engineering and Eric T. T. Gross, formerly assistant professor in electrical engineering.

HERBERT J. FEINEN, C.E. '27, has been with E. I. duPont de Nemours & Company on construction work since 1940, in Wilmington, Delaware; Louisville, Kentucky; Richmond, Virginia; Charlestown, Indiana; and now in Seaford, Delaware. At present he is field project manager on a project to expand Nylon manufacturing facilities.

ROBERT D. KELLER, M.E. '30, who has been a member of the scientific bureau of Bausch and Lomb Optical Company in Rochester since 1942, this fall became representative in the Southwest on the complete ophthalmic line for the company.

College News

(*Continued from page* 20)

and R. R. Meijer, co-chairmen of an interim committee which has been working on plans for the organization of the new society. Final action on these proposals will be taken at a later meeting.

The following temporary officers were elected: President: Simon H. Bauer of the Chemistry Department; Secretary: Miss Jane Faggen of the Physics Department; Treasurer: G. K. Kalisch of the Mathematics Department.

In his talk, Dr. Bacher emphasized the need for more widespread public knowledge of the basic facts concerning atomic energy. He said that it is the responsibility of the scientist to counter misinformation with fact. He also advocated freedom of scientific inquiry and closer relations between scientists of different nations.

HARRY J. LOBERG, who has been serving as assistant to the dean of the College of Engineering, has been promoted to Professor of Industrial and Engineering Administration, and named head of the new Department of Industrial and Engineering Administration, both appointments effective immediately.

ASME

ON Friday, February 15, the ASME held a meeting at which elections for the spring term were held. The new officers are:

Chairman: Robert Miller.
Vice Chairman: Randy Johnson.
Secy.-treas.: Jarman Kennard.

The speaker for the meeting was Gifford Bull, instructor of Aerodynamics in the M.E. School. His topic was "The Automatic Pilot."

Rod & Bob

ELECTION of officers for the spring term were held at a meeting of Rod and Bob on February 12. The following were elected:

Chief Engineer: Thomas F. Kiley.
Note Keeper: Robert McCarren.
Rod Man: Thomas Berry.

On Friday, February 15, Rod and Bob beat Pyramid in a basketball game between the two societies.

New Vets

ABOUT 1400 new veterans, more than half of whom are former Cornellians, reported to the Office of Veterans Education on March 5 for

(*Continued on page* 38)

College News

(*Conitnued from page 36*)

enrollment, in order to avoid delays in registration at Barton Hall on March 7. With the addition of these entering veterans, the total of returned servicemen on the Cornell campus will total about 2700. No civilians are being accepted for admission in the spring term either from secondary schools or as transfers due to the overwhelming number of applications received from ex-GI's, many of whom had to be turned away due to lack of facilities.

Chem.E.'s

A MASS meeting of the Chemical Engineers was held in Olin Hall recently. The subjects under discussion were the constitution for the chemical engineering student council, and the establishment of an honor system and committee. Robert Olson, president of the Chem.E. student council, conducted the meeting. The constitution was read and openly discussed, as were the proposed plans for an honor system. The student body voted in favor of these propositions. The honor system will provide a means of recourse for a student whose classroom integrity has been questioned. Previously he was allowed no official representative; but under the new system he can choose any one he wants, faculty-member or student, to present his case.

Atmos

AT an election meeting early in February, ATMOS elected the following officers for the spring term.

President: Charles Cox.
Vice-President: Larry LaFave.
Secretary-Treas.: Larry Aquadro.

THE appointment of Peter B. Kyle as professor of applied metallurgy in the School of Chemical Engineering at Cornell was announced today by President Day.

Professor Kyle's appointment will become effective as soon as he can be relieved of his duties as associate professor of mechanical engineering at the Massachusetts Institute of Technology, where he has taught since 1934. While at M.I.T. he was granted a leave of absence to act as a Research Supervisor for the War Metallurgy Committee.

After graduation from Cornell in 1933, Professor Kyle studied at Lehigh and M.I.T., receiving the degree of M.S. in mechanical engineering in 1939 at M.I.T. He was appointed instructor at M.I.T. in 1935, assistant professor in 1938, and associate professor in 1944.

AIEE

DR. CHARLES R. BURROWS, director of the School of Electrical Engineering at Cornell, spoke on "Recent Advances in Radio Wave Propagation" at a dinner meeting of the Ithaca section of the American Institute of Electrical Engineers in Elmira.

Dr. Burrows discussed new discoveries in wave propagation, important both to the tactical use of radar and radio communication and to peace-time industry.

Before coming to Cornell, Dr. Burrows was associated with the radio research department of the Bell Telephone Laboratories. During the war he acted as chairman of the Committee on Propagation of the National Defense Research Committee.

Adam Friederich

(*Continued from page* 18)

ENGINEER where he has since served in almost every position on the Editorial Board, and as Associate Editor for the past two years.

In the fall of '43 Paul joined the Cornell Chorus, and Pershing Rifles, becoming a member of the crack squad of the latter society. At the Spring Day Review of Cornell's 4200 troops in 1944, Paul was presented an award as ROTC Honor Cadet. The engineering department of CRG claimed more of his time during his first two years at Cornell. But in accordance with his division of time between scholastic work and activities, he made the Dean's List and was awarded a McMullen War Scholarship.

In his junior year, Paul began a reorganization of his interests. He was elected secretary of CURW having been vice-president of Freshman Club and a member of Sage Chapel Associates and the Public Affairs Department. With some encouragement by his contemporaries, he became interested in the Student Christian Movement and at the end of his junior year was chairman of a division of a state conference of that group. This June he will serve as chairman of the New York state conference at Silver Bay.

Following a long interest in boats, Paul joined the Corinthian Yacht Club in '45 and is now co-chairman of its building committee. Toward the close of his junior year, he was elected president of CURW and represented it on the Student Council for a time.

The local World Student Service Fund Committee also attracted Paul during his junior year. Following a trip to New York, he was a student member of the National General Committee of the Fund. This year he is co-chairman of the Campus Chest drive and following the pattern set in 1918, is trying to raise a quota nearly double that of last year, for the relief of students and faculty in Europe and China.

Now in his last term, Paul is trying the other side of scholastic life. He is teaching engineering drawing and so far has found it very interesting work; "It really keeps you on your toes," as he puts it. With graduation only three months away he is working hard to try to finish all the many projects in which he is involved. After graduation he plans to take advantage of an offer to remain at Cornell and obtain his MCE, along with more experience in the teaching field. Following that, he hopes to work in the field of building design, ultimately to open a consulting engineering office, possibly in combination with the construction business.

Tom Talpey

(*Continued from page* 19)

term, he was given three days leave and told to report to Cornell.

Here at Cornell, he is a candidate for a BEE degree, has the highest senior average in EE (88.7), is president of the Westminster Society, secretary of the AIEE, member of Tau Beta Pi and Phi Kappa Phi, corresponding secretary of Eta Kappa Nu, vice-commodore of CCYC, member of Navy and Cornell bands, and has been on the dean's list every term. In addition,

(*Continued on page* 44)

Tom Talpey

(*Continued from page 42*)

he was out for track and hockey, a member of the Navy rifle squad, and lighting man for an Octagon club show.

This term, Tom has been designing and constructing, with Henry Harper, a device which analyzes sine waves fed into it and plots graphically on the screen of a cathode-ray tube their vector representation in the complex plane. This original work, being carried out under the direction of Professor Credle, aims eventually at continuously plotting Nyquist diagrams for feedback amplifiers.

When he is discharged from the Navy, Tom plans to go on for some graduate work in engineering at either Harvard or M.I.T., and then entering some phase of design or research in engineering.

Profiles

(*Continued from page 17*)

In 1934 the Architectural League of New York awarded Mr. Clarke the Gold Medal of Honor for his work in connection with the development of the Westchester County Park System and in 1940 Yale gave him the degree of Doctor of Humane Letters for his contribution to the development of the park systems in Westchester and in New York City. He was also elected to honorary membership in the American Institute of Arts & Letters, the National Academy of Design, and the American Society of Civil Engineers.

In 1937 Mr. Clarke began a partnership with Michael Rapuano, Cornell '27, and in 1942 Leslie G. Holleran, formerly Deputy Chief Engineer for the Bronx Parkway Commission and subsequently for the Westchester County Park Commission, joined the firm, now known as Clarke, Rapuano & Holleran, Consulting Engineers & Landscape Architects. The firm has completed plans for parkways, expressways, parks, housing and industrial developments, and made reports for the replanning of municipalities. During World War II Mr. Clarke served as the Engineer for the Sampson Naval Training Base on Seneca Lake, and Consulting Engineer for two Army Bases in Newfoundland.

Mr. Clarke now serves as Consulting Engineer to the Westchester County Park Commission; the Department of Public Works of New York State; the Department of Parks, New York City; the Planning Commission, New York City; the Highway Department, New

(*Continued on page 46*)

Profiles

(*Continued from page* 44)

Jersey. He also serves as Consulting Landscape Architect to the Johns Hopkins University, Washington Cathedral, and to several other agencies both public and private.

In 1932 Mr. Clarke was appointed a member of the National Commission of Fine Arts by President Hoover, and in 1936, 1940, and 1944 he was re-appointed to four year terms by President Roosevelt. The Commission, the members of which serve without pay, is the agency to which all plans for public improvements in the District of Columbia are submitted for consideration and approval (the Commission does not have the power of veto) including buildings, parks, parkways, and monuments, as well as all sculpture and all mural paintings for public buildings. In 1937 Mr. Clarke was elected Chairman of the Commission, a position he still holds. As a member of this Commission of Fine Arts, Mr. Clarke fought successfully many times for the preservation of the "majestic valley of the Potomac."

Mr. Clarke served as a member of the Board of Design for the New York World's Fair, 1939, and was responsible for the general development plans for the grounds of that Exposition. He was also a member of the Board of Design for the development of "Parkchester," a housing development for more than 12,000 families built by the Metropolitan Life Insurance Company in New York City. He is now Chairman of that Board, which is responsible for three housing projects in the Borough of Manhattan, New York, namely Stuyvesant Town and Peter Cooper Village, extending from 14th to 23rd Street and from 1st Avenue to the East River, and Riverton in Harlem. These three projects will accommodate about 15,000 families and will cover a total of over 100 acres on Manhattan Island. For his "outstanding leadership in the field of town and city planning, including housing," Mr. Clarke was awarded the Frank P. Brown Medal of the Franklin Institute of Philadelphia in 1944.

In addition to his professional activities, Mr. Clarke has found time to serve as Professor of Regional Planning (since January 1935) and as Dean of the College of Architecture (since June 1939) at Cornell. For ten years, until 1944, Mr. Clarke spent 3 days each week at Cornell. Then, due to the war, registration in the College of Architecture was reduced and Mr. Clarke, with the approval of the Board of Trustees, limited his trips to one a month, an arrangement which still remains.

Mr. Clarke serves Cornell in still another capacity, namely, as Chairman of the Architectural Advisory Council. This body passes upon and recommends plans for all buildings and other improvements on the Campus to the Trustee Committee on Buildings and Grounds.

Mr. Clarke, at 54, is still engaged in a heavy work schedule, but he finds time for the opera each Thursday evening in winter, for his Church, and for golf. He is married and has one son, 1st Lieutenant Edward Perry Clarke, Cornell '43, a B-25 pilot until a short time ago, and two daughters, Elizabeth, who spent 3 years at Cornell just prior to the war, and Doris, now at school in Wellesley, Mass.

Columbia

supplies Industry with Essential Chemicals

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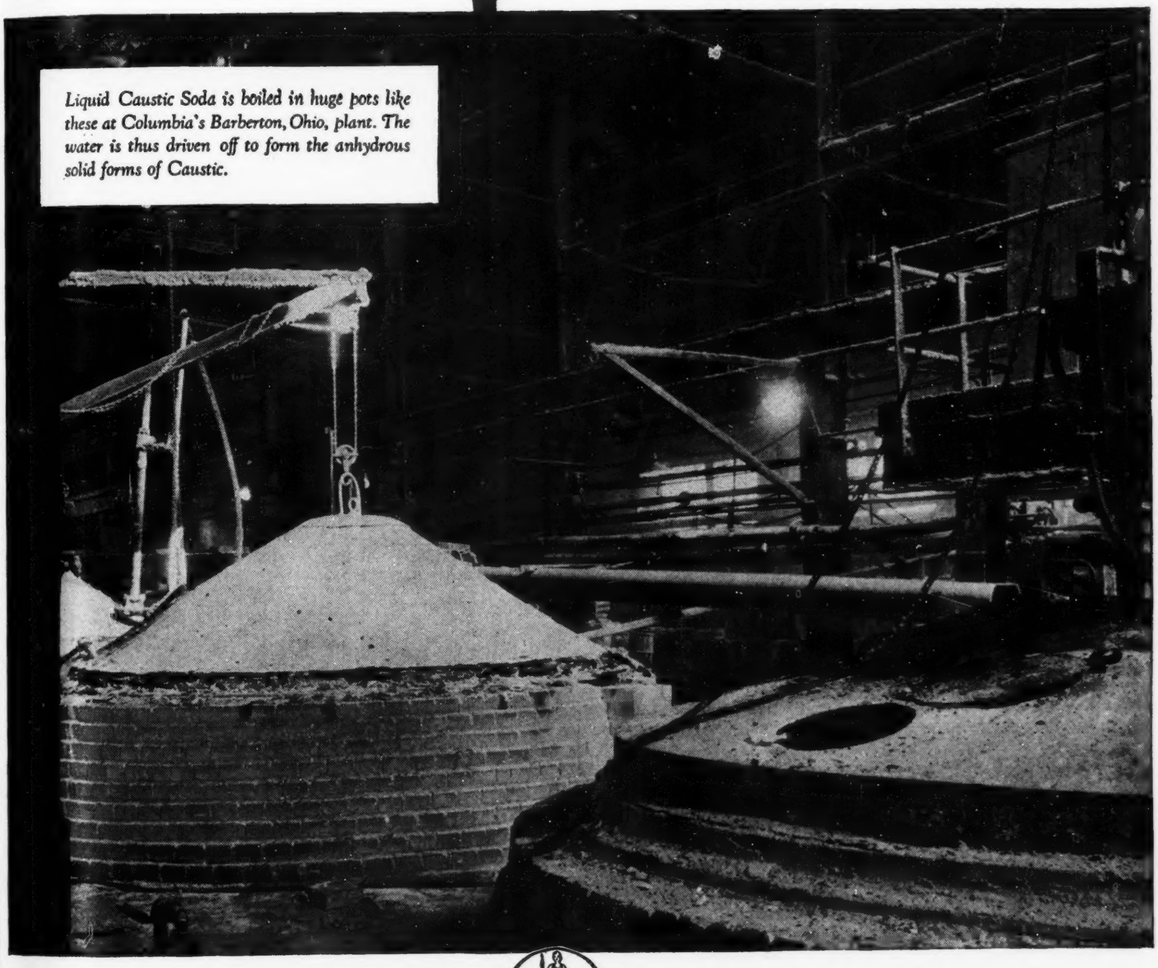
- CAUSTIC SODA
- LIQUID CHLORINE
- CALCIUM CHLORIDE
- SODIUM BICARBONATE
- MODIFIED SODAS

- CAUSTIC ASH
- PHOSFLAKE (bottle washer)
- SODA BRIQUETTES (iron desulphurizer)
- CALCENE T (precipitated calcium carbonate)
- SILENE EF (hydrated calcium silicate)
- PITTCHLOR (calcium hypochlorite)

Many of the nation's basic industries—such as Chemicals, Glass, Paper, Soap and Textiles—are dependent upon alkalies and related chemicals for essential processes in their production. Columbia has served these needs since the beginning of the century.



Liquid Caustic Soda is boiled in huge pots like these at Columbia's Barberton, Ohio, plant. The water is thus driven off to form the anhydrous solid forms of Caustic.

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5 Year Plan

(*Continued from page 16*)

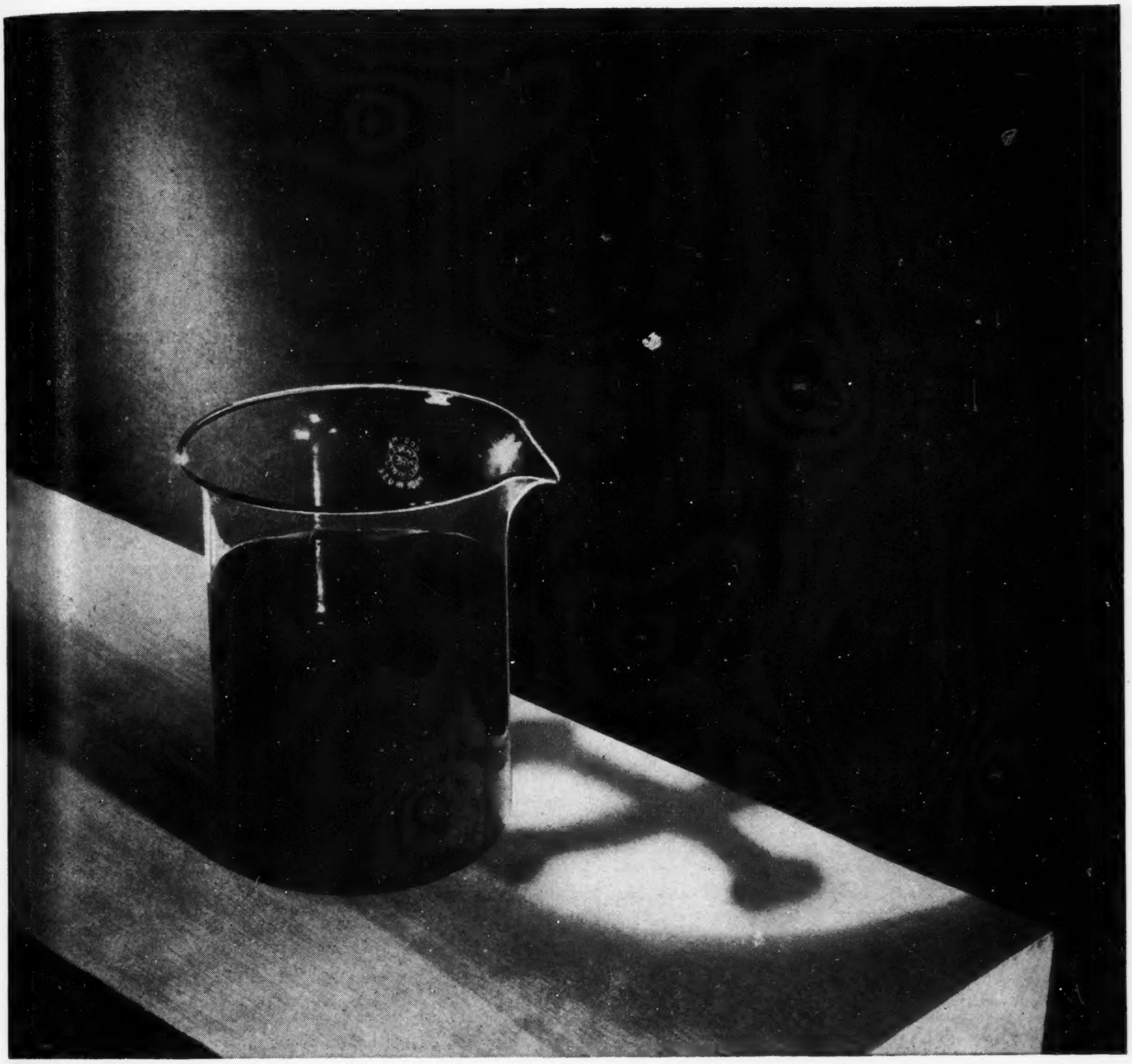
courses such as psychology and public speaking, and also with more electives. The general effect of the plan on the student is to provide him with a more rounded education, and a strengthened technical background which will give him a better start in industry, and a greater all-around fund of knowledge.

In addition to the changes mentioned above, the college of engineering will also feel the effects of the change from four to five years. Probably the most prominent effect will be a general revision of the individual courses. Many of the courses now taught will be gone over and revised and perhaps taught from a new standpoint. The trend for courses taught outside of the schools, is for them to be taught from a viewpoint that will be most helpful to the engineering student. For example there is a course in psychology now being taught in the school of chemical engineering especially for engineers who, most likely, will have no time to go any further in the field than one term will allow. This period of transition coming in the next few years will make an excellent chance that ordinarily would not occur for the faculty to make any changes necessary. With the proposed building expansion and this revised program, Cornell should have one of the leading engineering schools in the country.

The school of engineering at Cornell has taken a big step in adopting the five year program. Perhaps it is a risky venture, but the benefits to be gained from five year engineering courses are much too important to lose by sticking to the established college routine.

Comparison of Programs
For the School of
Mechanical Engineering

Credit Hours	Old Four Year Course	New Five Year Course
Technical Courses	126	134
Liberal and Managerial Courses	15	34
Electives	5	12
Totals	146	180



Hi-Voltage Lab

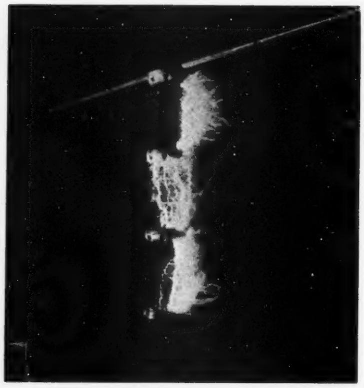
(*Continued from page 9*)

tor, and will pay dividends in avoiding complaint expense, in permitting improved designs, or re-rating old designs for newer applications.

High Impulse Currents

Apparatus required to withstand the effects of direct strokes of lightning may be given laboratory tests at high impulse current values. Studies of natural lightning phenomena by investigators throughout the world have compiled a considerable amount of data to indicate the nature and magnitude of the factors involved in natural lightning strokes. Consequently there is available technique for evaluating the ability of certain forms of apparatus to withstand the mechanical forces associated with the discharge of a natural lightning stroke. There is also a means of judging the thermal and dielectric problems involved when heavy and rapidly changing currents are permitted to flow through the apparatus.

Many dramatic effects accompany impulse current discharges involving hundreds of thousands of amperes, and much information is available in this field.



Wet Flashover 60 cycle test of a 161 KV Station Post Insulator.

Conclusion

High voltage engineering combines a wide range of techniques. Problems considered in this field are generally assumed to be associated with dielectric behavior—leakage, power factor, losses, dielectric strength, voltage distribution and voltage gradients etc. There is also a group of problems which fall into other fields, electronics, mechanical design, measurement of short times, measurements of high frequency, measurements of minute radio frequency currents in the presence of very high power frequency voltages, considerations of heat flow, effect of heating on dielectric strength, arc behavior, chemical reactions, vacuum and treating technique, standardization and economics.

The High Voltage Research Laboratory at Cornell is a growing organization with problems embracing an extremely wide range and of a very practical significance. High Voltage Engineering as practiced in this laboratory, or as Engineering is practiced anywhere is not a single routine perscribed activity, but rather a chain reaction of fundamental truths, estimates, hunches and inspirations, tempered by experience, consultation and knowledge. Above and beyond all is the whip lash of safety which demands that every action be guided first by a consideration of the people involved and the acknowledgement of responsibility associated with any work of engineering importance.

Du Pont *Digest*

Items of Interest to Students of Chemistry, Engineering, Physics, and Biology

NYLON—PRODUCT OF PURE RESEARCH

NYLON exists today because of curiosity—the curiosity of a group of Du Pont chemists who wanted to know more about polymerization, that strange process by which small molecules of a chemical unite to form larger molecules with entirely new and different chemical properties.

Du Pont chemists began a study of polymerization in 1928. They experimented with dibasic acids and within two years had succeeded in forming polyesters with molecular weights up to 25,000. In the spring of 1930, on removing one of these "superpolymers" from the molecular still, one of the chemists noted that it could be drawn out into a thin strand, like taffy candy. But, unlike taffy, it was not brittle when cooled. In fact, the cooled strand could be further drawn out to several times its former length and when so drawn became not only stronger but elastic!

This original ester polymer had a low melting point and was sensitive to water. Nevertheless, it suggested that some related type of polymer might produce fibers which would be of practical use in textiles.

Numerous superpolymers were synthesized and tested. Finally, in 1935, a polyamide was prepared. From it, the first nylon filaments were made—by forcing the molten polymer through a hypodermic needle!

Nylon Polymer Developed

Further experimental work resulted in the development of a polymer that possessed the desired characteristics. This material was later christened nylon.

But the job was not yet done. Research chemists—particularly physical chemists—and chemical engineers were called upon to devise practical methods for making the polymer and for spinning and drawing it into high-quality yarn. Mechanical engineers were given the task of designing plant equipment to carry out the processes. Organic chemists were required to develop new dyeing agents and to find a size to make knitting possible. At one time or another more than 230 research men, engineers and marketing specialists worked on the giant task of converting this child of chemical curiosity into a marketable product.

RESEARCH LOWERS PRICE OF SYNTHETIC UREA

Lower prices, as well as new processes, can result from intensive research. Take synthetic urea, for example. In 1930, urea sold for about 80¢ a pound. Great promise was held for this compound as an industrial chemical for fertilizer and plastic use—if an inexpensive manufacturing process could be found.

By methods then in use, ammonia and carbon dioxide were heated to about 150°C., forming urea and water in equilibrium with the unconverted original compounds. The yield of urea was approximately 43%.

Research by Du Pont chemists and engineers showed that, by adjusting the proportions of the reactants, raising the temperature and increasing the pressure, conversion could be improved materially. But the corrosive mixture resulting quickly chewed up the best grades of steel available.

Long investigation by metallurgists, chemists and chemical engineers finally produced an autoclave in which the operation could be carried on a production basis. Today, Du Pont is able to sell synthetic urea for less than 4¢ a pound. Men of Du Pont take pride in the fact that their work has made it possible to reduce the price of urea from the "drug" class to a level where it can be used as a fertilizer by the farmer.

Questions College Men ask about working with Du Pont

"WHAT ADVANTAGES DOES DU PONT OFFER A RESEARCH MAN?"

To men interested in pure or applied research, Du Pont offers unusual advantages in equipment, facilities and funds. Men of Du Pont are constantly developing new processes and products, and seeking improvements for established processes. Investigation in the fields of organic, inorganic and physical chemistry, biology and engineering suggest the diversity of the activities of Du Pont research men.

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STRESS and STRAIN...

The social worker was talking to a girl in a slum district and asked, "Where is your father?" "Oh, Pop's in the penitentiary," the girl replied. "What about your mother?" "She's in an insane asylum," answered the girl. "And your sister?" "She's been in the Reform School a couple of years." "Well, that just leaves you and your brother. Where is he?" "He's at Cornell." "What, you mean your brother is in college? What's he studying?" "Oh, he ain't studying nothing. They're studying him."

* * *

Then there was the congressman, who lost his voice shouting over the lend-lease bill. He stepped into a Washington drug store to ease his suffering tonsils.

"What affortment of ice cream do you ferve," he questioned the waitress noiselessly.

She leaned closer and whispered, "Juf ftrawberry, rafberry, and vanilla."

"Oh, do you have laryngitif alfo?" he asked hoarsely.

"No," she whispered again, "juft ftrawberry, rafpberry, and vanilla."

* * *

A lady bought a parrot from a pet store, only to learn that it cursed every time it said anything. She put up with it as long as she could, but finally one day she lost her patience.

"If I ever hear you curse again," she declared, "I'll wring your neck."

A few minutes later she remarked rather casually that it was a fine day. The parrot promptly said, "It's a hell of a fine day today." The lady immediately picked up the parrot by the head and spun him around in the air until he was almost dead.

"Now then," she said, "It's a fine day today, isn't it?"

"Fine day," sputtered the parrot, "where in the hell were you when the cyclone struck?"

Little Jack Horner
Sat in the corner
B.O.

* * *

"I want three cigars," piped up the Freshman.

"Strong ones or mild ones?"

"Gimme strong ones. The weak ones always bust in my pocket."

* * *

"Are you sure Joe B. was drunk?"

"Positive."

"Why are you so sure?"

"Well, I saw him put a penny in the mail box, look up at the clock on the Libe Tower and shout: 'By God, I've lost fourteen pounds'."

* * *

According to a recent report, dogs in Siberia are the fastest in the world. Probably because the trees are so far apart.

* * *

A young fellow was driving toward town. Suddenly he honked his horn and pulled over to the curb. A young lady got into his car. As they drove away he said: "When we get to the next traffic light you'll have to tell me whether it's red or green. You see, I'm color blind."

The young lady grinned at him and replied, "Ah say yo' is."

* * *

Farmer: "I miss the old cuspidor since it's gone."

Wife: "You always missed it—that's why it's gone."

* * *

"Hey," cried Satan to a new arrival, "You act as if you owned the place."

"I do," came the reply. "My wife gave it to me just before I came."

* * *

First Duck: "Who won the boat race down there below us, Cornell or Navy?"

Second Duck: "Cornell just crossed the finish line in the lead."

First Duck: "And to think, I put everything I had on Navy."

A Penn man sat down at a lunch counter and ordered four fried eggs, a dozen oysters, a grilled steak and a double order of French fried potatoes. After wading through these he polished off with six doughnuts, two pieces of pie and three cups of coffee.

When the waiter had finished serving, he remarked, "You must enjoy your meals."

"Far from it," replied the Penn man, "as a matter of fact, I hate 'em—but am I nuts about bicarbonate of soda."

* * *

One day little Audrey locked the bathroom door and threw away the key and then laughed and laughed and laughed because she knew her father was going to have a beer party.

* * *

The philanthropist had presented the insane asylum with a beautiful new swimming pool. "How do the inmates like it?" he asked the warden.

"They're crazy about it," was the answer, "We can't keep them out of it. And they like it even better when we put water in it."

* * *

Old Lady (to little boy smoking): "Don't you know that if you do that you'll never get to be President?"

Little boy: "That's all right, lady, I'm a Republican."

* * *

And did you hear about the little moron who struck his dentist because the old doc got on his nerves.

* * *

Optician: "What can I do for you, sir?"

Patient: "I need an eye test."

Optician: "And what makes you think so?"

Patient: "I was opening a safe and an orchestra began to play."

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